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The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

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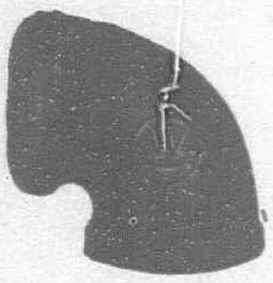

Fig. W2—Elbow

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Fig. W1—Elbow

Fig. W75—Flange

Fig. W13—Tee

Fig. W33—Coupling

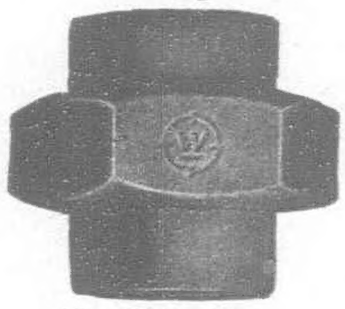

Fig. W46—Union

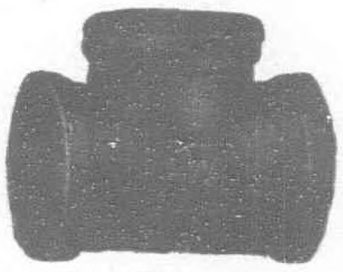

Fig. W14—Tee

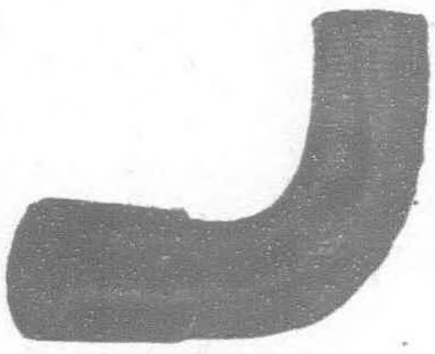

Fig. W21—Bend

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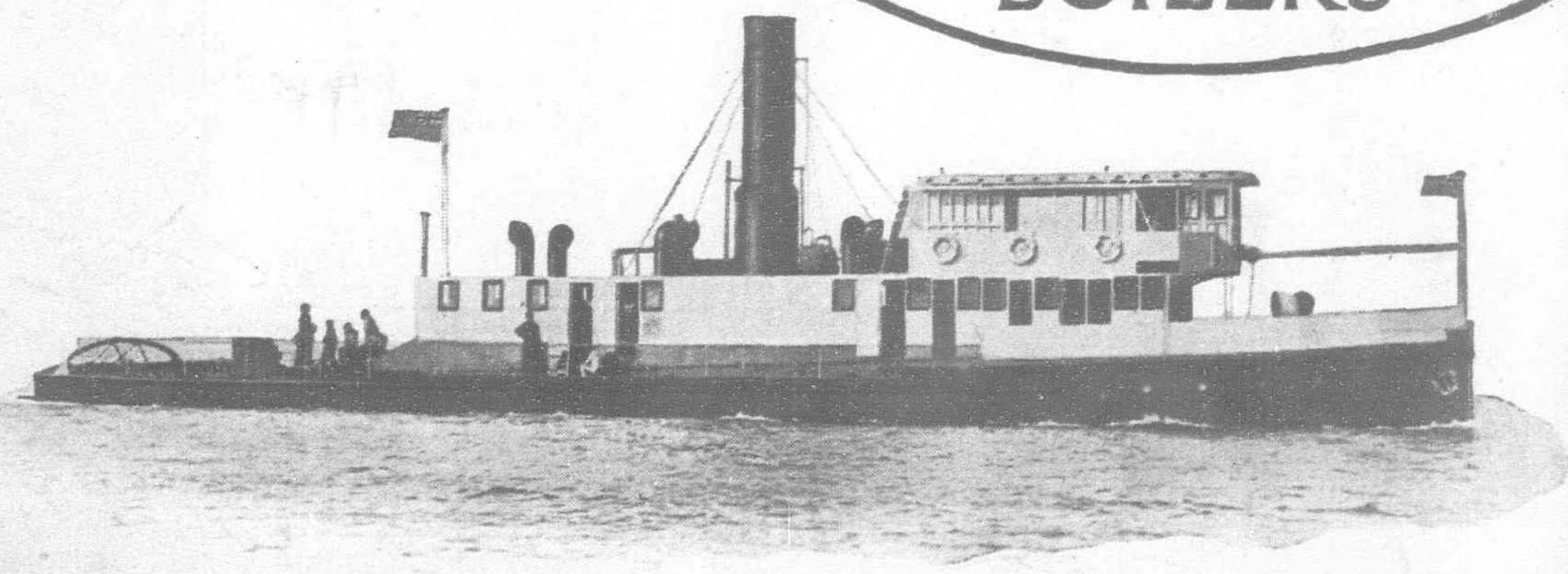

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, MARCH, 1923 No. 3

In Which We Return a Ton of Bricks

(Marked with the "XX Chop")

WE recall vividly and with certain sadness our earliest experience with bricks. A large pile of nice red ones was stacked up in the back yard of our boyhood home and we used to play building houses or when tired of this, tried to throw them over the fence into the neighbor's yard. It was great fun—while it lasted. We never knew exactly how it happened, whether a brick rebounded from the fence or whether our next door playmate threw it back. When we came to in the hospital a week or so later, we sported a triangular hole in the cranium which darkened our young life for many months. We then learned a very useful lesson about bricks; never to throw them with an uncertain aim. They have a habit of coming back in the most unexpected manner and from unexpected quarters.

Now amongst the modern industries of Japan is the making of bricks. One of the largest and to date most successful of these enterprises is the Kobe Brick Works. The output is not sold on the market for legitimate construction work, but specially made and used for the exclusive entertainment of a petulant editor who carts them every morning to his sanctum on Naniwa-machi, where he spends the day amusing himself by throwing them indiscriminately at everything Japanese that comes within his vision. Nothing escapes him: the Imperial family, the army, the navy, the gods, the temples, the priests, family life, morals, commercial integrity, the diet, the politicians, the police, the censorship, the banks, the man-in-the-street, everything from high international policies to geishas, yoshiwaras and phallic worship come under his scrutiny and unerring aim. When he tires of crowning the Japanese, he tries his hand on his contemporaries, his own country, or any unfortunate who arouses his ire or comes within the range of his strong right arm. One of his pet aversions in Japan is the Kokusai News Agency; in China, THE FAR EASTERN REVIEW. Now we have no objection to our contemporaries shieing a brick at us once in a while: we rather enjoy dodging them, throwing them back, or acknowledging the hit if a good score is made. Being swatted continually by the same humorist, however, simply because our views do not agree, grows extremely monotonous.

Evidence brought out in a recent lawsuit against the *Shanghai Mercury*, disclosed that the largest shareholder of this British registered newspaper is a Japanese. This provides the editor of the *Japan Chronicle* with the opportunity to express his thoughts on "Japanese Papers in China" and incidentally, to indulge in his favorite pastime of throwing a specially baked brick at THE FAR EASTERN REVIEW.

According to the successor of Robert Young, the case against the *Shanghai Mercury* discloses a curious state of affairs, in analyzing which, he asserts that the object of the publication of English language newspapers in China under Japanese ownership or part ownership, must be to represent Sino-Japanese relations in a light particularly favorable to Japan and therefore unfavorable to China.

"Paid advocacy of Japan in Japan" according to the Kobe brick artist, "just passes muster. It is not regarded quite in the same light as paid advocacy in the law courts. Paid foreign journalism in Japan always masquerades as *bonâ-fide* personal opinion . . . it *can* be undertaken and social ostracism escaped."

In effect, the owner of the Kobe Brick Works says that it is ethically wrong for a foreign journalist to present Japan's side of the case in a foreign language newspaper published in Japan: he may escape social ostracism, or he may not. As an insight into the working of the foreign mind in Japan and the reason underlying the consistent anti-Japanese policy of the *Japan Chronicle*, this admission is illuminating. Naturally, a foreign journalist owning or editing a newspaper in Japan, must receive his support largely from Japanese interests if he hopes to prosper, thus bringing him within the category of a paid advocate if he fails to live up to the business rules underlying all newspaper ventures by presenting the Japanese side of the case, and, when they are right, of defending them.

The *Japan Chronicle* then goes on to say that this rule cannot be extended to China and recalls that "when the *North China Standard* started publication in Peking there was great difficulty in getting an English journalist in spite of the high pay offered, as the position was uncomfortable socially. They had at last to fall back on a man who was under sentence of imprisonment in Japan." Now we submit that this is a most uncalled for slur on a brother journalist, inasmuch as we are reliably informed that the late Robert Young, personally recommended the man for the position. The extension of the rule to the *Shanghai Mercury* whose largest shareholder is a Japanese, would imply that its British directors, shareholders and employees, should also be socially ostracised by the local British community. Considering that Great Britain and Japan have been allies for many years, it would seem that occasions would arise when British journalists would be legitimately called upon to defend Japan and many of her Asiatic policies, which, after all, were also British policies.

After a dissertation on the morals of publishing Japanese papers in the United States, the Brick-Thrower turns his attention to China, whose case he says, is peculiar. "There are a great many Japanese papers published in Chinese in order to try to convert the Chinese to the Japanese view of international relations, and there are Japanese papers published in Japanese for the benefit of Japanese residents in China."

It is perfectly correct for the British to establish newspapers in Japan, in China, in the United States, and in all other lands under the sun. The Paris and continental editions of some of the great London dailies printed in English, according to the *Japan Chronicle*, must be maintained solely for the purpose of influencing French and continental readers to accept the British viewpoint of international relations, and when British money is invested in an American publication, the only deduction possible, is that it is put there in order to influence the American public along lines favorable to British interests—fighting the shipsubsidy bill, for instance, or the free use of the Panama Canal to American vessels. If the Kobe Brick Thrower reads the American papers closely, he will find many allegations that large sums of British money are

being expended in the United States to influence public opinion to accept the British viewpoint on important matters.

The right of the British journalist to squat down in a foreign country and attempt to sway public opinion in favor of British policies is a fundamental Anglo-Saxon prerogative. According to the Kobe editor, for the Japanese, or any other non-English speaking people, to adopt the methods which Britain has found highly effective in influencing world opinion, is an intolerable presumption, one which must be sat upon, and, if necessary, social ostracism applied to any foreigner with the moral courage to say a good word for them, or challenge the lop-sided opinions of such petty exponents of Japanese thought as the *Japan Chronicle*. It was eminently proper, however, for the Japanese to spend hundreds of thousands of pounds in *The Times Japanese Supplements*; it was nothing to their discredit that similar supplements were published and paid for in important American newspapers, but it was untactful, to say the least, for the Japanese to send all these good yen out of the country for publicity purposes while the *Japan Chronicle* as the leading British newspaper of Japan, was denied a piece of the pie.

However, all this is nothing to the greater crime of publishing a paper in English in China for the purpose of influencing foreign communities and to prejudice the Chinese case in the eternal struggle between China and Japan. "This is on an entirely different footing," continues the *Japan Chronicle*.

"When these papers are published under foreign flags the case is worse still. It is naturally regarded as a "double-crossing," in a variety of ways, too. Take the case, for instance, of THE FAR EASTERN REVIEW, once a noisy advocate of Chinese *versus* Japanese interests, but since the Paris Conference which its editor attended, an equally noisy advocate of Japanese interests *versus* China—but a hundred per cent. American all the while."

This is real brick-throwing, and as we have now accumulated several of the missiles hurled at us by the choleric proprietor of the Kobe Brick Works, we crave the indulgence of our readers while we return them to their owner.

On various occasions during the past three years, the *Japan Chronicle* has intimated by inuendo that THE FAR EASTERN REVIEW has been sold to Japanese interests during the Paris Peace Conference, "or, just before it changed its policy," a fabrication that because of our exact knowledge of who originated and communicated it to the late Robert Young, was beneath our dignity to notice. Unbiassed readers of this magazine now admit that its main policy has been justified by events: that it was essential to the higher interests of the United States, of Japan and of China, that Japan's side of the case be presented, a task that no journal in the Far East cared to accept, a task which, the *Japan Chronicle*, the oldest foreign edited newspaper in Japan and the logical medium for presenting her case, dared not accept. Furthermore, as the issue of the war that was to have been fought between Japan and America, was China, it was also essential that the truth about the actual conditions in this country be also set forth.

The *Japan Chronicle* is discreet enough to admit that this magazine has remained one hundred per cent. American through it all. Exactly, but when we started to clarify the atmosphere, we faced the charge of being most unpatriotic and the *Japan Chronicle* worked hand in glove with the inside clique in China that did its utmost to "put us out of Business."

As to "double-crossing" the Chinese, the records of this office will prove that as far back as 1917, when America severed relations with Germany and pressure was being brought to bear upon China to follow our lead, cabled instructions were sent by the publisher of this magazine to its editor to extend every support to the parliamentary party. We saw then that the entrance of China into the war under the leadership of the militaristic crew at Peking meant the death of democracy in this country. We invited the attention of President Wilson to a situation which placed him in the paradoxical position of calling upon the manhood of America to make the world safe for democracy in Europe, while by driving China into the war, we were consolidating the power of the military autocrats in this country. We have reason to believe that it was this letter which influenced President Wilson to send his note of June 2, 1917 to the president of China informing him that the maintenance of internal peace in this country was of greater importance to the allied cause than China's participation in the war. We mention this, merely to emphasize that at no time since 1916 have we been in sympathy with the military freebooters who have ruled and plundered China from Peking.

At all times our sympathy has gone out to the parliamentary party. We felt then, and still feel, that no true American could view the struggle in China for good government without siding with the man, who with all his alleged faults, represented those principles which rest at the very foundation of democracy. We have never departed from this conception of Americanism, as our various articles in support of Sun Yat-sen will tend to prove. This will assist the *Japan Chronicle* and other critics to understand why at no time since 1916 have we been able to conscientiously support a regimé that has proven itself the poorest apology for a government the modern world has witnessed. If this be "double-crossing" China, we plead guilty, but we have not yet committed the crime of "double-crossing" ourselves by defending Peking militarists, or of being untrue to our national cause when the support of every citizen meant the salvation of its ideals. *We were not fifty per cent. pro-German during the war and ninety-five per cent. Bolshevist after the peace.* No contemporary has been able to designate us as "the German editor" or question our relations with Moscow.

The above will also help to invite attention to the fact that in supporting Sun Yat-sen we adhered to a conception of loyalty, that his foreign detractors could not understand, for we hold with the Chinese, that one of the greatest virtues in this world is loyalty without which no cause can triumph. One of the most painful incidents of recent Chinese history was the spectacle of a foreign publicity agent of Wu Pei-fu revelling in and glorifying the act of treason which cost Sun Yat-sen control of the Canton government, and nearly the life of himself and his wife. We may be guilty of "double-crossing" the Chinese by presenting Japan's side of the case, but if this leads to a better understanding and an amicable adjustment of their differences, the world and China will be better off. We have not violated that cardinal Chinese virtue of betraying or slandering the man, who took us into his counsels and gave us the right to speak with authority on certain phases of the Chinese problem, and in so far as the Chinese continued to repose confidence in us to assist them with straightening out their intricate railway problems, we never betrayed their interests or reaped one cent of reward other than the very small salary tendered us.

As to the charge of "double-crossing" the Peking mandarinate, we make the simple statement, that "it can't be did." They can be depended upon to do this for themselves. They have "double-crossed" the foreigner at every turn, then turned to the latter to help them out of their troubles and "double-crossed" them while they were doing it.

The Peking grafters "double-crossed" themselves and their American friends in the Siems-Carey railway contracts of 1916, precipitating an international political situation coldly calculated to pit the United States against the four allies on the "open door" issue at a time when they were fighting for their existence in Europe. We antagonized all our American and Chinese friends because we would not support this contract. In addition, they "double-crossed" themselves and the people of China in this deal by undoing all the good work that had been done by THE FAR EASTERN REVIEW in their behalf towards securing the lowest terms for the financing and construction of their railways, and precipitated the revision of all their previous contracts and loaded down the nation with an additional burden by reviving foreign participation in the profits of the lines.

We make the simple statement that the entire railway scheme of Sun Yat-sen or the international deal of 1914 could have been negotiated without delay and the loans raised and placed to the credit of the Chinese Government within a week had the same terms been accepted by those who had charge of the negotiations—

but, they would have been hounded out of China or paid the traditional Chinese penalty for such a betrayal of their higher national interests.

We may add for the enlightenment of the *Japan Chronicle* that right here is where we terminated our "noisy advocacy of Chinese interests." We condemned a conception of American policy which condoned this intrigue against the allied cause and treason to the higher interests of China, thereby incurring the enmity of a group of Chinese grafters who tried to "double-cross" the United States, and the support of Americans who stood to benefit through the transaction. Because we could no longer uphold a a conception of American policy which could take advantage of this surrender of China's interests, we departed from this country in December 1916 and rather than embarass the administration by criticism or attacks remained silent until the war was over and the peace signed. We were then at liberty to express our opinions publicly. In doing so, we got exactly what we expected; a shower of bricks marked with the "XX chop" from those whose interests were best served by maintaining secrecy over their betrayal of China.

The Chinese "double-crossed" themselves when they signed the Shantung and Manchurian railway agreements of September 1918, and then "double-crossed" their American friends by maintaining these transactions a profound secret while our delegation went to Paris to fight their case for them. There was a lot "double-crossing" done about that time. Many Americans hold that President Wilson was "double-crossed" when America entered the war and was not informed by her associates of the existence of the secret agreements over Shantung and the Pacific Islands, and which America also remained in complete ignorance of until the peace conference was well under way. Americans were "double-crossed" by secret European diplomacy and "double-crossed" by secret Chinese committments, yet we were expected by the latter to win their fight for them. When President Wilson found it impossible to override these secret understandings and was forced to accept the Shantung decision to save the league the Chinese at once started to "double-cross" him by dispatching a delegation of paid agitators to Washington to "kill the treaty in the Senate" and China then "double-crossed" her allies by refusing to sign the treaty with Germany, slipped into the league of nations by the back door, under the provisions of the Austrian treaty, while her agitators in Washington made the weilkin ring over Shantung. This gave the American opponents of the treaty the opportunity they were looking for to knife Wilson. It busted the Versailles treaty and for all practical purposes killed the league when the American senate refused ratification. China enjoys and has made much capital out of her seat in the league, but she did so by "double-crossing" the man who made the league possible and provided the major arguments which kept America out of this new combination for world peace. The irony of it all is that the very agitators who were most active as agents of China in killing the treaty which kept America out of the league, have attended every meeting of this body and capitalized their presence there in Chinese publicity articles. All this knifing in the back and "double-crossing"; for what? Simply because President Wilson and the other members of the Big Three trusted to the honor of Japan to comply with her pledged word to restore Shantung to China, while the Chinese and their American supporters contended that Japan's word was worthless unless it was plainly stipulated in the text of the treaty. The whole nasty Shantung mess, which took another international convention to clean up, arose from this distrust of Japan and the desire to humiliate her in the eyes of the world, preparatory to the launching of the campaign that was to have precipitated the "Showdown" which it was hoped would lead to hostilities between Japan and America.

There is not an honest editor in the United States who does not now admit that Woodrow Wilson has been vindicated by Japan's withdrawal from Shantung. The pendulum has swung the other way and with the passage of two short years the American people now fully realize how they were imposed upon by sentimentalists and agitators who knifed their own president in order to curry favor with China. The following editorial which has appeared in over two hundred American newspapers, tells its own story:—

> "The Shantung award was accompanied with the distinct understanding and explicit assurance that Japan would at the proper time retire from China and return Shantung to the Chinese.
>
> "When Mr. Wilson became a party to this agreement, vials of wrath were emptied upon his head. Phrases like 'the crime of Shantung' were brandied about by the unthinking and yawped repeatedly in the senate by Lodge and his partisans. Wilson had sold out China to Japan—that was the cry.
>
> "To all this the president made the simple answer that 'he had faith in Japan' and in Japan's promise that the Mikado's government would at the proper time restore Shantung to the sovereignity of China.
>
> "The faith of Woodrow Wilson's in the integrity of one of America's allies in the great war is now completely justified."

And again, it will interest the *Japan Chronicle* to know that when we arrived in Paris in December, 1918, and was informed of the program prepared by the American and Chinese delegations, we condemned it without hesitation, holding firmly to the opinion that success could be attained only by the American delegation living up to the thrice declared intention of the state department and to have the German interests in Shantung surrendered to the Allies in the peace treaty, leaving Japan as trustee, until such time as a separate international convention could be called to settle the whole problem of China. It is needless to say that we became *persona non grata* with both delegations for daring to challenge the wisdom of their program. Our one consolation is that we have since learned in Mr. Lansing's book and later in Mr. Ray Stannard Baker's presentation of President Wilson's story of the peace, that our opinion was subsequently acted upon, but only at the eleventh hour and with defeat staring China and the United States in the face. It was then too late. This is another reason why bricks of all sizes and shapes from those who had to defend their mistakes, became our portion, as soon as it was over, and we condemned their tactics. In the same manner as President Wilson was accused of selling out China to Japan, so the story was secretly circulated that THE FAR EASTERN REVIEW had been sold to Japan because we had the courage to denounce the tactics which made the decision possible and protest against the political treason which sent Americans scurrying to Washington in the pay of China to "kill the treaty" and stir up hatred against Japan.

As a result of this Shantung *fiasco*, America was to have been "double-crossed" and railroaded into a war with Japan over China, not by the Chinese themselves, so much, as through the activities of her foreign advocates and at least one adviser, who had the plans of campaign all drawn up to hold the fort at Peking pending American mobilization. Does the editor of the *Japan Chronicle* wonder that an honest American newspaperman declined to permit his country to be "double-crossed" in this manner without making some attempt to present the other side of the case? If there was any "double-crossing" of China by THE FAR EASTERN REVIEW in contributing to the collapse of this infamous conspiracy, the *Japan Chronicle* certainly did everything it could to "double-cross" us by associating itself from the beginning with those who were most active in throttling any attempt to have the other side of the case made known. It ranged itself solidly alongside the enemies of Japan and hurled mud at those who honestly endeavored to pave the way toward a better understanding.

When the inside history of the past five years is written, it will be known to posterity as the "double-crossing" period following the great war, in which a group of anti-Japanese fanatics and foreign agitators placed the interests of China above those of their own countries and demolished the work of the Paris peace conference and the Anglo-Japanese alliance. The great instrument created by President Wilson for the maintenance of world peace and a square deal to China was destroyed and the United States placed outside its scope by the agents of its beneficiaries. History will also record that Woodrow Wilson was betrayed and his great work undermined largely through the instrumentality and activities of his own compatriots whose sympathy and allegiance to their Chinese paymasters overshadowed loyalty to their president and

interests of their own country. History will furthermore record that as a result of President Wilson's simple faith in the honor of the Samauri, the propaganda was set in motion by the American and British advocates of China whose consequences could only have been another terrible war in the Pacific. Far above the welfare of the United States and her associates in the war, far above the interests of world peace and the league created to maintain it, was placed the interests of China, who alone of all the nations reflected the idea that the pledged word of Japan would be fulfilled in Shantung. Behind her stood a few Americans who dynamited the edifice their president so painstakingly erected and prodded their country along the road to hostilities. "Save China," was the slogan given out at Peking, yet to do this meant the overthrow of the only instrument that could have guaranteed her future integrity, the humiliation of the president of the United States and the precipitation of hostilities in the Pacific. It took another special international convention to terminate the campaign, a step which, if taken at the outset, would have avoided all this political treason and cemented world peace at the signing of the Versailles treaty.

In the same manner that Americans sold out Wilson and hastened to "kill the treaty in the Senate," so history will record that a similar fanatical group of Britons placed the interests of China above those of the empire and pulled down the Anglo-Japanese alliance, the one effective guarantee for Asiatic peace and protection of India against the constant menace to its security from the north. Fortunately, we were a hundred per cent. American in this, or we would labor under the "stigma" of being a paid advocate of Japan and as such to be ostracized by decent society. Of all the contemptible arguments ever employed by one newspaper editor to injure another, this is the worst. Even when faced with a war, which would have completed the demoralization of our civilization, the editor of the *Japan Chronicle* in his blind, rabid, unreasoning antagonism to Japan would have denounced as an undesirable, unfit to be associated with, any journalist who would have attempted to advocate her case in English. The *Japan Chronicle* learned nothing from the lessons of the great war, and could not know that the decent people of America and of his own country were fed up with lies and one-sided propaganda, and classified as enemies of humanity those who would again stifle the free expression and exchange of thought.

Li Hung-chang "double-crossed" Japan after the war of 1895 by entering into a secret alliance with Russia and handing over her territories to the latter in order that she might be revenged upon Japan. The Manchus then "double-crossed" the entire world by remaining a silent partner and ally of Russia during the war of 1904-05, escaping payment of the penalty and emerging from the conflict as the injured and innocent victim. According to Viscount Kato, Yuan Shih-kai "double-crossed" him in the matter of the twenty-one demands: Tuan Chih-jui "double-crossed" Japan over the Nishihara loans: the militarists "double-crossed" Americans after their government prevailed upon the other powers at Washington to give them a square deal; they "double-crossed" their own credit at home by issuing unauthorized internal loan bonds, and abroad by violating the principle of priority and breaking down their pledged securities.

The domestic history of China for the past decade is one long nauseating recital of "double-crossing," of treason, of jobbery and corruption in high places, and the saddest part of it all is that otherwise sensible foreigners who would not tolerate similar conditions in their own country, are forever taking sides in these Chinese domestic squabbles and upholding the wrong-doers.

Yuan Shih-hai "double-crossed" the Manchus, then "double-crossed" Sun Yat-sen in order to attain the presidency, and after he had "double-crossed" the parliament he attempted to "double-cross" the republic he had sworn to uphold. Since his death, Chinese political history is the story of sordid squabbles, of one group of grafters "double-crossing" the others. Coming down to the past year, we have witnessed a "war" between Chang of Manchuria and Wu of the Kin-Han, in which one of Chang's generals "double-crossed" his leader and handed the victory over to Wu: Chen Chiung-ming "double-crossed" his patron and chief, Sun Yat-sen, and forced him to fly from Canton to save his life, while the foreign sycophants of Wu Pei-fu loudly applauded and commended these most despicable of treasons. Wu's faction "double-crossed" its leader, Tsao Kun, forced president Hsu out of office, exiled his chief henchmen and elevated Li Yuang-hung to the vacant chair: now Tsao Kun's *entourage* is "double-crossing" President Li and paving the way for Tsao to take his place. And because a foreign newspaper published in China declines to join the clique, in which the Kobe Brick-Thrower is a prominent member, and applaud all this "double-crossing, its attitude is qualified as a "treacherous abuse of extra-territorial privilege." On the other hand, when other writers take the lead in discrediting Sun Yat-sen, glorify the contemptible treachery of Chen Chiung-ming and exert all their powerful influence to boost the cause of Wu Pei-fu, this constitutes no interference with the internal affairs of China; this is no abuse of extra-territorial privilege. This is simply the heaven-sent prerogative of a select clique which must not be extended to outsiders.

In conclusion, we would point out that those who live in conservatories should be extremely careful in the promiscuous throwing of bricks. All the arguments employed against Japanese papers in China apply with equal force to British-owned papers in Japan, and with special reference to the *Japan Chronicle*. When their government is charged with suppressing independent thought and opinion and of imposing its views on the press through censorship and police regulations, most any intelligent Japanese will point to the existence of the *Japan Chronicle* as proof to the contrary, explaining that it has been permitted to continue publication in order to prove to the world that Japan *does* tolerate the free expression of thought, even when that thought is consistently inimical to their higher interests. This could not happen in any other country that we know of.

The *Japan Chronicle*, we admit, has a legitimate grievance. It now faces an era of peace and co-operation between Japan and America and better relations between Japan and China. The present situation can be summed up briefly in the following extract from a speech delivered by Ambassador Warren before the Pan-Pacific Union at Honolulu on February 5. Referring to the "atmosphere of splendid friendship" on the Pacific, he said:

> "But—it was not always thus. Things were very different in the area of the Pacific when I went to Japan. Those persons who think not, don't know.
>
> "More than a year ago, distrust and suspicion made the relations of Japan and the United States almost dangerous—potentially dangerous. This distrust and suspicion have been largely removed. The task I went to Japan to do has been accomplished. If it hadn't been, I shouldn't be here now.
>
> "Trade across the Pacific is increasing. In fact, the only foreign trade of the United States that is increasing is with Japan and the Orient, and the only foreign trade of Japan that is increasing is with China and the United States.
>
> "I said the other day at Peking that Japan wanted to be a good neighbor to China. I said it because I believed it, but more important, far more important than the fact that I said it, was the fact it did not arouse resentment. Relations between Japan and China are better—gloriously better; and I think I know something about it."

It must be disappointing to the Far Eastern Amalgamated Union of Brick Throwers to watch the gradual coming together of China and Japan, depriving them of a favorite pastime, and in many cases, of lucrative employment. By presenting Japan's side of the case in China and frankly explaining their own mistakes, the Chinese are slowly gathering an idea of how they have been "doubled-crossed" by their own corrupt officials and the above-mentioned hard-working labor society who capitalized their ignorance. We have no fear when the proper time arrives that intelligent Chinese will concur in the opinion of the *Japan Chronicle* in that we have "double-crossed" them or "treacherously abused" our extra-territorial privileges. The day is coming, when an honest government will again direct the affairs of this country. When that day arrives we will have the satisfaction of knowing that we were one of the very first to see ahead and place ourselves on the

side of good government, long, long before any of the other so-called friends of China visualized the dangerous trend of affairs which have brought the country to its present unhappy position.

THE FAR EASTERN REVIEW has been consistent in its opposition to any foreign loan to the Peking government that would perpetuate the present situation, also one of the first to tell the truth about conditions at a time when others were slurring the consortium and advocating a huge loan to Wu Pei-fu. Again, we have the satisfaction of knowing that our opinions faithfully reflected the policy of the American and Japanese groups in the consortium, and from the recent speech of Mr. A. G. Stephen, chairman of the Hongkong and Shanghai Banking Corporation, we now understand that this view is fully shared by the highest British financial authority in China and reflects the attitude of the British group. Mr. Stephen said :

"As long as the present conditions persist and until the people of China show their determination to insist on effective measures being taken by the government for disbandment of troops, consolidation of unsecured debts and unification of the country, *every attempt to assist China from the outside must be regarded as futile.*"

That this opinion is fully shared by the representative of the American group is seen in the prolonged vacation to be taken by Mr. F. W. Stevens, who will probably not return to Peking until a proper government is established that the consortium can deal with.

Just a word about noise before we close. If THE FAR EASTERN REVIEW has been noisy in its advocacy of Japanese *versus* Chinese interests in the past three years, it is simply because it required considerable pounding on the drum to drown the sound of the quiet, steady, tapping and hammering of the Japanese anvil chorus led by the master knocker who rang the keynote from his forge in Kobe, and hurled bricks between blows at all who attempted to distract attention from his monotonous amusement.

Returning to the subject matter of this article, our advice to the *Japan Chronicle* is to get out of the brick business, dispose of the plant for what it will bring and invest the proceeds in a nursery. There are many beautiful flowers in Japan. Throw an occasional bouquet instead of a continual shower of bricks. Someday the editor of the *Japan Chronicle* may look out of his sanctum window and see stretching far down Moto-machi the formation of a line with bricks, carried by a multitude of apologetic Japanese, courteously determined to return the missiles to their owner. The successor of Robert Young, if he happens to have a cyclone cellar, may then remember our advice, and as he picks himself out of the ruins of the little old office building in Naniwa-machi, may perhaps think of starting that nursery. "Say it with flowers."

Why Are the Philippines?

Go Ask the British

THE JOURNAL OF THE AMERICAN CHAMBER OF COMMERCE of the Philippine Islands propounds the conumdrum, "Why are the Philippines" and then waxes wroth over the failure of their compatriots at home to understand the place of the archipelago in the Far Eastern scheme of things-how, as an American possession, they fit in : how their trade stacks up : how that trade can be developed, if at all : and if continued tenure of the islands is worth while from an economic standpoint. The journal invites attention to its invitation to Mr. Isaac F. Marcosson to visit the islands when he came to the East recently, assuming that this gentleman would be particularly interested in the above problems from the standpoint of their relation to American foreign policy, political and economic. Although the representative of the *Saturday Evening Post* accepted this invitation when he got to Shanghai he found that his time was too much occupied by an investigation of the weighty problems that confront China. The journal continues :

"On reading his articles and noting his amazing familiarity with Chinese names and places, we do not wonder at his great preoccupation in that country. He must have spent at least two hours a day memorizing names and keeping them straight, so as not to get them mixed up in his articles. . . Be that as it may, Mr. Marcosson did not come to Manila, and the American public now has a full and circumstantial account of the recent troubles in China, a complete and detailed running story of the Japanese political machine, and a masterly analysis of the economic status of both countries, together with a series of prognostications—none of which have as yet turned out to be true. Of the Philippines casual mention is made here and there, the total amount of space devoted to these unhappy and insignificant islands not aggregating more than six inches out of a total of several hundred or perhaps thousand."

"Now for our second indictment. Congressman L. C. Dyer, of St. Louis, Mo., is the father of the so-called China trading act. It seems that Mr. Dyer was a member of the congressional party that visited the Far East in 1920. On his return to the United States he at once took up the 'White Man's Burden' in China, became the champion of American trade in the Pacific and went about obtaining relief for the American trader who in competition with the traders of other nations was having a hard time of it to make both ends meet. His own American government was largely responsible for the American merchant's troubles because it imposed iniquitous and handicapping taxation upon him, according to Mr. Dyer. Hence this burden had to be lifted, and lifted it was through the China trading act, which was slipped through congress in exchange for the killing of the anti-lynching bill, also a product of Mr. Dyer's fertile brain."

"Soon after the passage of this bill, its author decided to come to the Orient to witness its workings. He happened to be in Shanghai at Christmas time. An invitation came to him from Manila to spend the holiday season there. He came, and in the course of his visit was requested to address the American chamber of commerce. Mr. Dyer made a neat speech on the China trading act, a speech that almost brought tears to the eyes of his listeners in commiseration of the hapless American trader in China. To the amazement of the numerous American business men present, however, he never even mentioned their own troubles, though he might have been aware of the fact that American business men in the islands have quite as much to contend with in the way of handicaps imposed by their own government as have the American traders in China. That there were similar problems and conditions to be righted under his very eyes, beneath the folds of the Stars and Stripes, never seemed to occur to Mr. Dyer. It was clear that he did not know the true answer to the question appearing at the head of this article."

"Why are the Philippines ? For years we've tried to tell the people of the United States that the islands are as large as the empire state of New York and some of the New England states combined ; that their fertile lands are capable of producing all the tropical products needed by the United States ; that their forests abound in the most beautiful hardwoods in the world ; that there are in the islands millions of acres of the richest soil still untouched by the plow or untrod by a steer ; that the people are progressive and their needs rapidly rising ; that our trade with the islands is constantly increasing and now ranges between $100,000,000 and $200,000,000 a year ; that the islands are ideally situated from a geographic standpoint to serve as a trade base and distribution centre for the entire Far East ; that they constitute the keystone to the entire Far Eastern problem ; that they are the most valuable trade asset of the United States on the Pacific, and that the American businessman here is in as much need of federal assistance and cooperation as his compatriot in Japan, China, Timbuctoo or Saskatchewan.

"These are some of the things we have been shouting from our house tops, but evidently our houses are not high enough or our voices are too weak, for as yet but a very insignificant portion of the American populace seems to be well enough informed to make an intelligent reply to the question : "Why Are the Philippines ?"

Why then with all these advantages have the American people refused to accept the chamber's definition as the answer to the big question ? We could write a book on the reasons why, but Americans in the Philippines, like their compatriots in China, are extremely sensitive to the truth. However, without raising debatable questions, we might say that the fundamental reason why Americans do no accept the Philippines at their face value is simply because that, at heart as nation, we are missionaries, philanthropists, educators and uplifters. When we took over the Philippines, instead of applying business-like methods to develope their resources, we laid down the fundamental law that we were there as trustees for the Filipinos to maintain their lands intact until such time as we educated them to our conception of popular government. We

raised all manner of obstructions to the influx of American business men and capitalists and sent over shiploads of school teachers. We then enacted laws which prohibited corporations from owning large areas of land and extended our exclusion act to be certain that no outside Asiatic labor would deprive the native of his patrimony. Our mission in the islands was purely altruistic and we have lived faithfully up to the principles originally laid down for our guidance. We now have the inevitable result in the second generation. We have accomplished a great educational task : we have unselfishly borne our share of the " White Man's Burden " : we have uplifted the native and placed him socially, politically, intellectually and in all other respects, on a plane of equality with ourselves. It has been a wonderful example of unselfish missionary endeavor. We are proud of our work.

But missionary endeavor and trade do not always harmonize. We have attained the halo of righteousness but failed as business developers. The islands remain practically undeveloped, the rich soil untouched by the plow or untrod by the steer is still in its virgin state : the development of forest industries is handicapped by unnecessary restrictions, half the hemp grown rots in its stalks, the sugar industry, of which great things were expected, languishes for lack of labor, while the great island of Mindanao is a *terra incognito*, an empire of tropical wealth rotting under the rays of an equatorial sun.

What has our altruism actually cost us in dollars and cents ? When we think of the great volume of tropical produce that pours into the United States from other quarters of the globe and on which we gladly pay a high tribute in export and import duties and other excessive charges by reason of their being monopolized by other nations, we can understand something of the enormous sums Americans have been called upon to pay for their altruism in the Philippines. We will cite one single instance and go no further.

The rubber boom struck the Far East in 1908. Hundreds of companies were organized in England, in its Asiatic colonies and in the ports of the Far East to develop rubber plantations in the Federated Malay States, in Sumatra and in Borneo. Millions of capital flowed into these enterprises and to-day, fifteen years later British Malaya controls the world rubber output. As a result of recent legislation restricting output and regulating prices, rubber is again booming and we find that American manufacturers must pay the British companies who control the raw rubber supply an annual tribute of something like $600,000,000. Before Americans can escape the payment of this contribution in six or seven years, it will wipe out the British war-debt to the United States. American manufacturers are weeping, wailing and gnashing their teeth over the prospect, but from the looks of things, they will have to toe the mark and " come across."

When everybody in the Far East was taking their savings out of banks and emptying their old socks of coins to invest in Malayan rubber shares, several efforts were made to attract attention to and invite subscriptions to shares in Philippine companies to develop rubber plantations in Mindanao. They failed. The people here laughed, and then begged, borrowed or stole more money to buy Malaya shares. Why was this ? Simply because Americans had made it difficult for capital to own and operate large plantations in the islands and enacted laws which prevented the importation of labor to work them. Not a share of Philippine rubber stock could be sold in Shanghai. Americans who speculated wildly in British company shares would not even consider a proposition coming from a land under their own flag. There were no guarantees that the enterprise would succeed. We must now pay tribute to a nation of men who never permit altruism or idealism to interfere with their trading and commercial instincts and necessities.

The British also hold Malaya in trust for its real owners, governing the states for their respective sultans. They have learned by long experience that the Malay is not fond of hard labor, but they eract no barriers against the entrance of other Asiatics to develop its resources. In this one instance, our missionary propensities have maintained Mindanao, one of the largest islands of the world, closed to development on a large scale, holding it in trust, like an Indian reservation at home, for a people who can never colonize or develop its rich resources. Our experience with rubber alone will cost us several billions before we are through with the experiment, a loss that we can now never make up. Like in all other missionary work, Americans at home must foot the bill while others reap the material rewards. Americans have achieved in the Philippines the object for which they put forth their best efforts. Our colonizing experiment has been a wonderful success, a glowing testimonial to our philanthrophy and unselfishness. We have given of our best and raised an Oriental people to a high standard of civilization, but we have not brought them real prosperity, nor have we won their gratitude. Such prosperity as has come to the islands is not because of their tropical fertility or the industry of the natives. It is purely artificial, paid for out of the pockets of the American people, who have remitted the import tariff on their sugar and tobacco, opening for them a market and permitting the development of these industries to their present state of productivity. Not only have we given unselfishly of our culture and civilization and raised their standard of living of the natives, but we have gone deep down into our pockets and made them a present of the prosperity they now enjoy. Will we ever be permitted to reap financial returns on our investment ? Never, under the present scheme of things, or until a way is found for capital to develop the islands and bring in the labor essential to make the investment profitable.

As we write this editorial, *Reuter's Service* under date of February 20, brings us the news that seven hundred and fifty American rubber manufacturers have been invited to a meeting on February 28 to discuss combative measures against the restrictive British rubber scheme, and at the same time says that a huge corporation with $50,000,000 capital is being promoted to develop new sources of supply and to bring pressure on the supporters of the restrictive scheme. We are also informed that the war department advocates rubber growing in the Philippines, but manufacturers are lukewarm in that connection, favoring the development of Latin-American sources should comprehensive action be taken.

Here we have the answer of " Why is the Philippines " ? Fifteen years after the damage is done, and facing a yearly donation of $600,000,000 to a nation of practical colonizers, Americans are now trying to repair the damage. Do they turn to the Philippines, that wonderful dependency under the flag, with its untold acres of virgen soil untouched by the plow and untrodden by the steer ; do they visualize the immense richness of that tropical empire in the great island of Mindanao that alone could supply all the rubber the United States could consume for the next century ? When the chance is offered, they favor the development of Latin-America, nearer home, where they can jump on a steamer, junket down and look at their rubber trees growing and get back in time for the next game of golf. The possibility of the Latin-American governments holding them up in the future with export taxes, exorbitant freight or other charges moves them not. The land that is under their own flag across the Pacific is a long distance away, no longer a commercial asset but a political liability, a campaign nightmare in which home issues are complicated by " Little Brown Brothers " waving bolos and screaming for "Independence With or Without Strings!" And although the insular government has no money to devote to proper industrial propaganda, it can appropriate a million pesos to keep up the campaign for independence in the United States. The bark of the *politico* drowns the feeble of the merchant ; voiced the cry of the American chamber of commerce is not heard beyond the mouth of the Pasig.

The Philippines have staggered under the burden all these years, and that they have reached their present stage of prosperity is due to the initiative, bull-dog persistance and the unconquerable pioneer spirit of the American element who have made the islands their home, and in spite of government laws and regulations. The Truth ? Who wants to know the truth ? Americans are satisfied with themselves in their rôle of altruists : we will have no other explanation. We have carried out our high mission in the islands and any American who would delve beneath the surface of things would be characterized as a backslider. However, it was not all

pure altruism which influenced our government to safeguard the lands of the Filipinos from exploitation and prevent their development by outside labor.

The truth about the Philippines is simply this: in order to hamper the growth of the insular sugar industry for the benefit of the domestic beet growers we enacted a law which prohibited any corporation from owning large tracts of land such as are essential to the profitable operation of a modern central sugar factory under one ownership. The domestic sugar interests have, since the occupation, practically dictated our national policy in the islands, opposing and then knifing Mr. Taft's free trade bill in congress and then forcing him to accept a limitation on the importation of duty free Philippine sugars (and tobacco) into the United States as the price of his nomination as candidate for the presidency. Taft and Roosevelt worked like Trojans to advance the interests of the islands, but the trusts which dominated the republican machine, killed their work, imposed their own conditions on the party, and fathered the land enactment which drove the final nail in the coffin which interred the industrial future of the islands, while the labor element sang the requiem over the poor little corpse to the strains of the exclusion act.

What prosperity the island now enjoys is due largely to the development of the sugar industry, the result of a compromise originated by the publisher of THE FAR EASTERN REVIEW in an after dinner talk with Mr. Palmer, the head of the beet sugar lobby in Washington, a compromise rejected at the time by President Roosevelt, Secretary Taft and General Edwards, but which they were subsequently forced to accept under the exigencies of campaign politics.

All talk about preserving the lands of the Philippines for the benefit of their inhabitants is pure moonshine. Take away that land restriction and permit the entrance of Chinese laborers and the sugar industry will grow by leaps and bounds, the rotting tropical empire of Mindanao will blossom like the rose: real prosperity will come to the far away isles of the Southern Seas. This is the one "nigger-in-the woodpile," the one fly in the molasses. To preserve the home market for the highly protected beet sugar farmers and factory owners, the bars have been erected that prohibits any other industry from gaining a foothold in the Philippines. For this protection to a pampered domestic industry holding the farmer vote club over our legislators by the most powerful lobby in the country, the nation is now called upon to pay itself out of its own pocket, the cost of a great foreign war, a mere bagatelle of five billions of dollars. Why, then, are the Philippines? Go ask the British. They have found the answer.

G. B. R.

Courting the Fate of Greece

A Vindication of Japan's Military Program

FOR the past three years we have lost no legitimate opportunity to explain Japan's vital policies in Asia which call for incessant vigilance in Manchuria and the urgent necessity of maintaining her army at a highly efficient state of preparedness to defend not only her own position but that of China against the ever present menace from the direction of Urga. Wilfull misrepresentation of her aims by hysterical propagandists, however, has inclined the world to believe that this preparedness cloaked sinister designs of conquest and to reject the idea that Russia could come back and be a menace within a generation. Japan's defensive military program is now vindicated by the highest American military authority, the soldier, who as chief of staff to General Pershing in France, and as assistant chief of staff of the American army after the war, enjoys a reputation as a strategist second to no army commander in the world. Major-General James G. Harbord recently resigned from the army to accept the presidency of the Radio Corporation of America, and freed from the restrictions of red tape has spoken his mind freely on the woeful state of the American army at the present time which lays us open to the same calamity which befell Greece: we are courting the same consequences. The Red army, he says, is the greatest in the world, and in obedience to the more or less direct pressure of the Soviet, Great Britain has been displaced in Constantinople and Japan forced to evacuate Vladivostok, cities at the opposite ends of Asia and nearly 8,000 miles apart.

"Consider this change of sovereignty," adds General Harbord "in connection with the fact that the Red government of Russia is maintaining to-day by far the largest army in the world. If with all her disorganization and her status as a virtual outcast among the nations, her influence is felt so strongly at such distances, the the world may well speculate as to possible combinations to which Russia may be a party, while Germany, in the bitterness of defeat and economic distress, is seeking a friend if not an ally."

Ponder over these words from the foremost American strategist and then say whether Japan is justified or not in taking every precaution to defend the political existence and independence of her empire. General Harbord's address was made, however, for the benefit of Americans whose indifference to strategic problems has permitted the army once more to lapse into a state of inefficiency, numerically weak and unable to faithfully discharge its function in the scheme of national defense.

Speaking as a private citizen at a luncheon of the National Republican Club in New York on January 20, Major-Gen. James G. Harbord made the startling statement that without definite plans for our defense in keeping with our position in the world to-day, "we are taking the same chance that Greece took and we are courting the same disastrous consequences."

The message of the old assistant chief of the American expeditionary forces is of such importance to the welfare of America that we reproduce it in full for the benefit of Americans in this part of the world, not only as an incentive for them to contribute their efforts towards the maintenance of a proper national defence army, but so they will see with a clearer vision how Japan has been cruelly traduced and villified for adhering to a defense program that their own country would do well to follow. General Harbord speaks with the wisdom of the ages, when he says that to hold a seat at the head of the conference table, a nation has to have an army and navy, and the larger the fighting force and the will and ability to use it, the greater influence will it exert in world affairs. When the full import of General Harbord's message is grasped, our readers will understand why we have so consistently upheld the Anglo-Japanese alliance as the surest guarantee of preserving peace in Asia and Great Britain's position in India. The Soviet pressure was behind the collapse of Britain's dreams in Constantinople; if the pressure is shifted to Central Asia, there will be no Japanese army to apply the brake from this end. The four-power pact will not take the place of the instrument that was destroyed at Washington. The menace from the direction of Urga is an ever present one to Japan, no matter what China or her friends may think about it, and her policies in that part of Asia simply announces that she is

determined to place herself in a position to endure as a nation, with or without the consent of the rest of the world.

Gen. Harbord declared that he wished to emphasize the vital importance of having such a plan "in a state of fire-alarm readiness for execution."

"There are those who," said Gen. Harbord, "for reasons of their own, will tell you that we need no such plan; that this country was never in less danger of attack than at this present moment. Possibly so. I sincerely hope so, but I cannot forget that we have been told that same thing in every generation of this country's history, and that, in spite of such assurance, no generation has been without urgent need of such plans or has failed to suffer for lack of them.

Points to Fate of Greece

"Within the past few months we have seen what may happen to a country in consequence of not having had definite plans commensurate with the position it has assumed in world affairs. We have seen its armies in defeat and disgrace; its high officials condemned to death and executed; its government overthrown by outraged people.

"Within the last four months two important cities of the world have changed hands in obedience to more or less direct pressure from the Soviet government of Russia, displacing Great Britain in the one case and Japan in the other. These cities are Constantinople and Vladivostok—cities at the opposite ends of the great continent of Asia and nearly 3,000 miles apart.

"Please consider this change of sovereignty in connection with the fact that the Red government of Russia is maintaining to-day by far the largest army in the world. If, with all her disorganization and her status as a virtual outcast among the nations, her influence is felt so strongly at such distances, the world may well speculate as to possible combinations to which Russia may be a party, while Germany, in the bitterness of defeat and economic distress, is seeking a friend if not an ally.

Turkey's Quick Comeback

"In October, 1918, after complete defeat, Turkey signed an armistice. Her army which had lost 600,000 men by disease alone, was demobilized and scattered all over Western Asia. If there was a single nation in the war more completely humbled than the other defeated combatants, it was unquestionably the Ottoman empire. Demoralized and dismembered she seemed utterly prostrated. Within two years she has rallied from that condition by the organization of an army and is talking ultimatums on terms of equality with our late allies in the great war. This indicates the potentialities of a national army in being and a people willing to fight.

"In the limitation of armament conference in Washington in the autumn of 1921, China, with her standing for integrity among the yellow races, her 400,000,000 of people, and her tremendous expanse of territory, sat near the foot of the table below Holland, Italy and other second rate powers.

"Near the head of the table, with less than a twentieth of her territory and a mere fraction of China's population, Japan was sitting in the seats of the mighty!

"With less reputation for integrity and dependability among the other yellow or white races than China, why was Japan in the seat of honor and China in the tail of the procession? The whole world knows that Japan is willing and able to fight. A nation has to have a navy and an army to sit at the head table in any world conference.

"Now, let us consider for a moment the defense measures to which the people of this country are asked to give their support. Just what do they amount to?

An Army of Non-Professionals

"Briefly, they involve the support of a professional force barely sufficient to provide for the peace time needs of our overseas garrisons and for the preservation of internal order, together with a non-professional, civilian force of approximately three hundred and seventy-five thousand officers and men, an aggregate of about half a million, less than one man to every two hundred of our population—and three-quarters of that force composed of non-professional soldiers.

"In the matter of cost, if we are of the calibre to count cost in a matter of such consequence, it amounts to the pitiful difference between enough and too little, a matter of a few millions each year; a mere fraction of what we wasted during the world war through lack of such plans; a tithe of what we throw away on unnecessary luxuries and contribute to the bootleggers; an insignificant fraction of our national budget.

"But let me remind you that all of this is being done on a purely voluntary basis. The great majority of those who are laboring earnestly to make this scheme of defence mean something are doing so voluntarily and at the expense of time and effort that the average man devotes to golf, poker or bridge. What they are asking of the country in return is confidence and support—the kind and amount of confidence that the business man gives to his legal adviser, his architect, his engineer or his general manager; the amount of support required to provide for bare necessities.

"Gentlemen, this matter of national defense is not a political issue, as some are inclined to make it. It is not a matter that the political profiteer or the synthetic statesman should be permitted to exploit in his own selfish interests. It is not a question of whether this party or that shall be enabled to go before the country with a record for economy falsely made by bartering our security.

"It is wholly a question of whether or not this country shall be placed in a position to endure with or without the consent of the rest of the world."

* * *

Hongkong and Canton

ONE of the most significant parts of the speech of the chairman of the Hongkong & Shanghai Banking Corporation at the ordinary general meeting of its shareholders held in Hongkong on February 24, deals with the popular belief that British interests have steadily opposed the development of Canton as a deep-water port. As we have at various times referred to this Chinese view, we take this opportunity of presenting the other side, which effectively clarifies the matter and paves the way for a much better feeling between the Chinese and British, and a coming together on questions which have long irritated the Southern Chinese party.

Mr. A. C. Lang, in his very able presentation of Far Eastern trade and finances during the past year, placed the British position on record in the following words:—

"I would like to take this opportunity of speaking more particularly on a question which concerns both the policy of the consortium and the future interests of this colony. Allegations have been made in a responsible American quarter, and urged with an insistence which would seem to give them the character of a deliberate anti-British propaganda, that a treaty or agreement with the British exists whereby the Chinese may be debarred from creating railway facilities necessary for the development of a deep-water port for ocean-going vessels at or near Canton; and that, although such development would be the natural accompaniment of any scheme for the completion of railway communication from Hankow to Canton, it is the fixed policy of the British to oppose it, as being detrimental to the trade of Hongkong. I am in a position to state categorically that no such treaty or agreement exists. Article 15 of the Canton-Kowloon Railway loan agreement contains an undertaking, usual in railway agreements where the line constitutes the security for the loan, that the Chinese government will not allow another line to be built competing with that railway to its detriment; but this clearly refers to competing parallel lines, and could not possibly be held to preclude the Chinese government from constructing whatever terminal facilities they choose for the long-projected Hankow-Canton Railway. Whether river improvement and the construction of a deep-water harbor at Canton are practicable or not at an expenditure which would be justified by the advantages to be gained, is a question for experts to decide; I am told that they are not. However, this may be, I am persuaded that no development of trade facilities at Canton can, in the long run, be detrimental to this colony, and our Chinese friends may be assured that British policy in this matter is bounded by no such narrow outlook as that attributed to it."

This is frank, clear and to the point and is so far as THE FAR EASTERN REVIEW has contributed towards creating any misunderstanding of British policy by presenting the Chinese viewpoint, we are now equally glad to correct it. The misconception about British ideas arises solely from the interpretation the Chinese place on Article 15 of the Canton-Kowloon Railway agreement, which, they assert, prohibits them from constructing a spur from the present railway line to the river opposite Whampoa. The Chinese have inclined to the belief since the survey for the line was completed, that it was deliberately carried far away from the river so that no spur could be built that might enable them to divert freight and traffic to deep water below Canton. There has always been a feeling amongst the Chinese, that any attempt on their part to develop the port of Canton would meet with opposition from British financial interests. This idea, we have reason to believe originated when Dr. Sun Yat-sen drew up his plans for the improvement of Canton and devoted as much attention to this scheme as he did to his favorite railways plans. We are also convinced that much of the initial British antagonism to Dr. Sun arose from the knowledge that he intended to push forward his scheme for the betterment of Canton, and develop a deep-water port at Whampoa.

The British position now set forth so clearly by the chairman of the Hongkong & Shanghai Banking Corporation will clear away all misconceptions and disabuse the mind of Dr. Sun Yat-sen of British antagonism to his pet scheme. Once British hostility to Dr. Sun is terminated, one of the greatest obstacles to the unification of China will be eliminated. The speech of Mr. Lang will be welcomed in more than one quarter.

Not a Leg to Stand On

CHINA'S parliament has instructed its foreign minister to notify Japan of the abrogation of the Manchurian treaty of 1915 signed as a result of the twenty-one demands, in which the original lease to the Kwantung peninsula is extended to 99 years. The original lease (succeeded to by Japan in the Portsmouth peace treaty) signed in March, 1898, expires in March, 1923, and the Chinese now demand retrocession of the territory on the grounds that the extension was obtained under duress.

The agitation for the return of this territory was started by the Chinese several months ago, bouyed up by the hope that public opinion in the United States would bring pressure to bear on its government to intervene in their behalf. It was not known to the Chinese that Japan and America had reached a tacit understanding in regard to the former's position in Kwantung, a sort of an unofficial gentleman's agreement in which the United States accepted that any interference with Japan's acquired rights in Kwantung would result in hostilities. We once discussed this same question with a very high foreign-office official in London, and he said practically the same thing: "the Japanese are there, they will fight before they will get out: you can depend upon it that Great Britain will never send troops to that part of the world to assist in putting them out."

For the past four months, or since the agitation was started for the annulation of the Manchurian treaty, the highest Japanese authorities have expressed themselves in various ways and at various times as to what their answer would be in the event the Chinese government abrogated the treaty of 1915 and officially communicated the fact to their minister at Peking. In effect, they unanimously state "we will refuse to discuss the matter." Under such conditions, if China should persist in denouncing the treaty, the situation so created would call for a severance of diplomatic relations and preparations on either side to defend their position. In the event that China should be foolish enough at this time to precipitate such a crisis, the consequences would be upon her own head.

In our December number we presented a symposium of articles on the various phases of the Manchurian question in which we fully explained Japan's side of the case as communicated to us by several responsible Japanese officials. In these articles, the truth was brought out that certain inside facts surrounding the presentation of the twenty-one demands and the ultimatum have been maintained a profound secret by both sides. The world has been permitted to see only the outward manifestations of an intrigue, the true facts surrounding which may not be divulged for another generation. The highest Japanese official connected with the presentation of the demands (Viscount Kato) has made the statement that the ultimatum was specially invited by the Chinese authorities in order to save their face before the nation, and Dr. Sun Yat-sen, Tang Shao-yi and the late Wu Ting-fang have repeatedly asserted that the demands themselves were drawn up or suggested to Japan by Yuan Shih-kai as the price he was willing to pay for recognition of his right to mount the dragon throne. We have since been informed by one of the highest authorities in Peking that evidence exists to substantiate the statement that the intrigue went even deeper, that documents are available to prove that Yuan Shih-kai actually financed from the proceeds of the reorganization loan the political campaign of Count Okuma which elevated the latter to the premiership of Japan. These various half-told stories reveal the existence of some secret understanding between Tokyo and Peking which neither side are willing to divulge during the life time of the principal actors in the play. This partial lifting of the veil of secrecy however, helps us to understand something of the reasons which prompted Japan to depart from the usual diplomatic procedure and invite world censure of her activities at such a time of world stress. It will also explain the much criticised statement of Count Okuma to Bishop Bashford three months before the demands were presented, in which Okuma conveyed to Yuan through Bishop Bashford, the message that as long as he was premier of Japan there would be no cause for friction between the two countries, or words to that effect. The concoction of a subsequent pact between the two to support each other would explain why Okuma departed from the policy so forcible outlined to the American bishop.

The statement of Viscount Kato cannot be lightly ignored: the accusations brought against Yuan Shih-kai by Dr. Sun and his close adherants have never been denied: the recent revelation of Yuan's pact with Okuma, while highly improbable, all tells us that the real story of the twenty-one demands remains to be told. The iniquity surrounding these negotiations was not all on the side of Japan, who appears to be the victim of a "double-crossing" on the part of Yuan Shih-kai in which the world accepted the Chinese side of the case, for the simple reason that Okuma and Kato were compelled to observe a discreet silence. Japan may be constrained to reveal the truth before the incident is closed.

Any discussion over the legality of Japan's position in Kwantung must go behind the twenty-one demands and invite an examination into the reasons why she came to be there at all. Waiving aside superfluous arguments and documents and the recital of unnecessary history tending to becloud the question, the discussion must be carried back to the close of the Sino-Japanese war in 1895, in which the Kwantung territory was ceded to Japan in the Shimonoseki treaty of peace. Russia, supported by France and Germany

Official Text of the Treaty of Alliance between China and Russia, May, 1896.

Filed by the Chinese Delegation at the Washington Conference.

"Article 1.—The high contracting parties engage to support each other reciprocally by all their land and sea forces in case of any aggression directed by Japan against Russian territory in Eastern Asia, China and Korea.

"Article 2.—No treaty of peace with an adverse party can be concluded by either of them without the consent of the other.

"Article 3.—During military operations all Chinese ports shall be open to Russian vessels.

"Article 4.—The Chinese government consents to the construction of a railway across the province of Amur and Kirin in the direction of Vladivostock. The construction and exploitation of this railway shall be accorded to the Russo-Chinese Bank. The contract shall be concluded between the Chinese Minister at St. Petersburg and the Russo-Chinese Bank.

"Article 5.—In time of war Russia shall have free use of the railway for the transport and provisioning of her troops. In time of peace Russia shall have the same right for the transit of her troops and provisions.

"Article 6.—The present treaty shall come into force from the day on which the contract stipulated in Article 4 shall have been confirmed. It shall have force for fifteen years."

" advised " Japan to forego the fruits of her victory on the mainland of Asia in the interests of Far Eastern peace, and faced with this coalition of the three strongest world military powers, Japan wisely surrendered her prize in exchange for a cash indemnity.

The modern history of the Far East dates from this episode. There is just one question that China has to answer in this controversy. Did Li Hung-chang enter into a secret alliance with Russia aimed at Japan ? Did she cede her territories to Russia in accordance with the terms of this alliance for the avowed purpose of enabling Russia to prepare for a war of revenge upon Japan ?

The Chinese government answered those questions at the Washington Conference when its delegates officially revealed for the first time the actual text of the treaty of alliance. The world is now accurately informed that this secret alliance was actually signed at St. Peterburg in May, 1896 and was to endure for fifteen years, or until May, 1911 : that the specific object of this pact was to support each other against Japan : that China was to permit the Russian fleet free use of her ports during such a war ; and cede the right to construct a strategic railway through Manchuria. Supplementing this treaty and in pursuance of its objects, China furthermore leased to her secret ally in March, 1898, the Kwantung peninsula and ceded the right to construct the South Manchuria branch of the Chinese Eastern Railway, connecting the fortress with the main strategic line at Harbin.

Russia then feverishly fortified the already formidable stronghold of Port Arthur, created the city of Dalny, and flung her battalions into the Manchurian territory in preparation for the war of revenge that was to drive Japan out of Korea. That war was fought. Russia was driven back into Northern Manchuria at a cost to Japan of over 200,000 men and national bankruptcy, and to keep pace with Russia's preparations for another war of revenge, Japan was still further compelled to increase her military establishment and burden her people with a staggering load of taxation to maintain her position.

Why then, is Japan in possession of Port Arthur and the Kwantung peninsula ? Ask the spirits of the 200,000 gallant Japanese whose graves dot the Manchurian landscape ? Ask the mothers and fathers, the widows and children of those who sacrificed their lives in the defense of a homeland that was to have been taken from them and the yoke of a foreign conqueror placed on their necks through the double-dealing of China ? Do we wonder at the thunderous voice of protest that goes up from one end of Nippon to the other when it is suggested that they surrender the prize which cost them so dear ?

Was China an ally of Russia during the war of 1904 ? The treaty of alliance was never denounced. China fulfilled her engagement under the pact when she opened her doors for Russia to walk in. She is equally responsible for the consequences. Owing to the secrecy surrounding the existence of the treaty, China escaped paying the price which Japan could have exacted at the Portsmouth Peace Conference. The truth, however, is now before the world. Has Japan the right to go behind the twenty-one demands and insist upon the legality of her position in Kwantung ? If the question is ever brought before the League of Nations, the Hague Tribunal or any other international court of justice, China will not have a leg to stand upon.

There is one road to the peaceful settlement of this question ; one solution that will bring China and Japan together in lasting friendship. China must recognize and admit her own part in precipitating the Russo-Japanese war of 1905. China must make full acknowledgement of her responsibility for bringing this calamity upon Japan. Then, and not before, can she hope for a friendly hearing from those she " double-crossed " and injured by reason of her secret understanding with Russia. Demands upon Japan to clear out of Kwantung can only make a bad matter worse. It is not a question of humiliation on the part of China, but the frank manly avowal that she has made a mistake, that she is willing to make such honorable amends as is in her power. Japan can not be bluffed by threats or coerced by the pressure of powers friendly to China. Japan has placed herself on record that she will fight before surrendering or restoring Kwantung and the other nations of real men know that she will keep her word. Roosevelt's maxim " speak softly and carry a big stick " should be taken to heart by China at this time, for without the strength and will to back up her position, she is courting certain disaster.

* * *

The Indictment of China's War-Lords

ONE year ago we predicted that within twelve months world opinion would swing around and turn against China in the same manner as it had turned against Japan, and as China lost in world esteem, Japan would regain its confidence. To-day, the Chinese government as distinct from the people stands almost without a friend, indicted on all sides for its failure to take advantage of the bill of rights extended to it at Washington. Following our own exposition of the facts, others have torn away the screen of publicity and focussed the lime light on the real situation in China. Last month, we gave prominence to the findings of Congressman L. S. Dyer, the personal representative of the president of the United States, and below we conclude the indictment of the military overlords by presenting extracts from the speech of the chairman of the Hongkong & Shanghai Banking Corporation and that of Minister Jacob Gould Schurman at the Washington Birthday dinner of the Anglo-American Association at Peking. Mr. A. O. Lang (Chairman of the H. & S. B. C.) emphasized the financial situation and the impossibility of the consortium affording relief in existing circumstances. He said :

" The political history of China during the past year has again been one of deep disappointment ; and the general condition of the country, so far from realizing the fair expectations raised by its delegates at the Washington Conference, has become steadily worse. The standing army is larger than ever, and continues not only to be a crushing financial burden upon the country, but its ill-disciplined units have become a serious menace to both foreign and Chinese life and property everywhere outside the protection of treaty ports. Bands of brigands, consisting of deserting or unpaid soldiery, maraud through the provinces, burning, looting and kidnapping with impunity ; while the whole country continues to be rent by ever-shifting political dissensions and military intrigues. The Peking government, central only in name, is a puppet in the hands of contending *tuchuns*. The railways are over-run, their traffic disorganized and their equipment damaged by hordes of disorderly troops. The revenues which should go to maintain the railways and to pay the service of the foreign loans secured on them, are appropriated at their source by the military authorities. Over-shadowing this chaotic condition of affairs like a dark cloud, is the load of unsecured indebtedness, foreign and internal ; an indebtedness with which the Peking government, in its present circumstances, has shown itself entirely unable to deal unaided ; but which measured by the area, wealth and population of the country, would, if properly consolidated, entitle China to be placed almost at the head of the solvent nations of the world. So long as present conditions persist, however, and until the people of China show their determination to insist upon effective measures being taken by the government for the disbandment of troops, the consolidation of the unsecured debt, and the unification of the country, every attempt to assist her from outside must be regarded as futile. The consortium, which was formed to give much assistance, must continue to stand by, a patient and passive spectator of events. No financial assistance which would serve the real interests of China, while at the same time securing protection of bondholders, is possible in existing circumstances."

Minister Schurman's indictment was more in the nature of a diplomatic recital of the facts surrounding China's failure to meet the expectations of the Washington conference and put her house in order, and although it constituted a scathing rebuke to the military masters of the country, it breathed the true American friendship for the great masses of patient, dependable Chinese whose first concern in life is the eternal struggle for existence. Minister Schurman also believes that the day is coming when an honest government will once more come to China, but holds that this can be attained only through the instrumentality of the educated classes, the merchants, bankers and other elements which go to make up public opinion in this country. It is to these educated classes that China must turn to in order to solve her own problems, a task in which no other power can help them, except with sympathy and good-will, a task, as Mr. F. W. Stevens pointed out, will require much self-sacrifice and the possession of the qualities of which martyrs are made. The great Chinese people have not lost the friendship of the other nations : they are now in exactly the same position as Germany was

during the war when the world turned its vials of wrath upon the heads of the military leaders. The Chinese lack a leader around which they can gather for the purpose of overthrowing the rule of the *tuchuns*. That leader will arise, and as China once more returns to her proper place in the comity of well-government nations, those who now condemn and criticise her, will be the first to applaud and assist in the difficult task of reconstruction.

In expressing his opinion on the Peking government Minister Schurman simply invited attention to the existence of seven cabinets during the past year which in itself makes unnecessary any discussion as to its stability. "Since the Washington conference passed the resolution urging China to disband her troops, four civil wars have been fought in different parts of the country, each a struggle for political and military control by rival leaders. Banditry has steadily increased in China in recent years reaching during the last twelve months even alarming proportions." Under the above conditions, it has been impossible for any friend of China to extend a helping hand in stabilizing the government by financing any one group. As one of the consortium representatives remarked to us in Peking recently, "they (the Chinese) won't stand still long enough for us to negotiate with them." And we now see in the speech of the chairman of the Hongkong & Shanghai Banking Corporation and in the proximate departure of the representative of the American group from Peking an extended vacation, that the financial leaders have given up hope for the present of contributing through loans to any scheme of short of real unification and a permanent settlement of their differences amongst the Chinese themselves.

This colossal task, Minister Schurman reminded the Chinese, is exclusively their own concern. "Foreign nations can be of assistance only by manifestations of goodwill and sympathy and by rendering such specific service as China may ask of them. Concluding, he said that this has always been the attitude of the United States towards China. A warm friendship between the two governments and peoples has been built on that solid foundation of community of interest and altruistic service. The American people and the American government earnestly desire—I may truthfully say that millions of them devoutly pray—that this friendship may grow in depth, in intensity, in unalloyed sincerity and cordiality. There is nothing, I am confident, which the American nation ranks higher in China except indeed the jewel of its own soul. I mean justice, the inviolability of the lives and lawful rights of its citizens, and its own national dignity and self-respect," in other words, the honor of the flag and what it stands for, the honor that was outraged by the Chinese militarists at Kalgan when they fired on the American consul and murdered an American citizen while pursuing his lawful business under his protection. The indictment of the Peking government is now complete, and it is squarely up to the Chinese themselves to set their house in order and regain the sympathy and respect of the world which they have lost while engaged in discrediting Japan.

* * *

Sun Yat-sen

THE star of Sun Yat-sen is again in the ascendant. It is gratifying to all lovers of fair-play to witness the return to Canton of the popular leader who was so treacherously ousted only a few months since by his trusted lieutenant. In the meantime Dr. Sun has undoubtedly reflected over his attitude towards Hongkong, and the British also have had time to consider his side of the case as presented some months ago in the columns of THE FAR EASTERN REVIEW. In returning to Canton, Dr. Sun stopped over at Hongkong and while there the leading British authorities and himself had an opportunity to exchange ideas and come to an understanding. The open and frank exposition of British policy concerning the development of the port of Canton by the chairman of the Hongkong & Shanghai Banking Corporation, following so shortly after Dr. Sun's visit to that port, would indicate that one of the chief grievances of Dr. Sun against the British has been removed.

The visit of Dr. Sun to government house and his enthusiastic reception and speech before the students of the Hongkong University have further helped to clear away misunderstandings. Once British opposition to this Chinese leader is withdrawn, and their newspapers and writers concede him a square deal in publicity, the day will not be far distant when the rest of the world will be willing to accord him his rightful place in Chinese politics. With foreign opinion friendly to him, the masses of educated Chinese who take their cue largely from the foreign press, will turn to him as their leader, and follow him in the great task that lies before all patriotic Chinese.

Sun Yat-sen is human; he has his limitations. He may fail to bring order out of chaos, he may be defeated in his plans for unification. Compromise and appeal to the higher instincts of the *tuchuns* may be of no avail in re-establishing a representative and stable government and the leader of the people, whether it be Dr. Sun Yat-sen or some other champion, may have to combat force with force. Sun Yat-sen stands for those principles which all Anglo-Saxons have sacrificed their lives in the past to uphold.

He is essentially a non-militarist; fundamentally honest and patriotic. He has no personal ambitions and invariably in the past has sacrificed himself for the good of his country. His position as the head of the Canton government gives him an equal standing with the *tuchuns* and although it is to be sincerely hoped that compromise and concessions on all sides may bring unification, the warlords may reject any interference with their acquired rights and refuse to submit to a central authority. In which case, is Dr. Sun to be held up as the one disturbing influence in China if he meets force with force? Whether it be Sun Yat-sen or some other champion of good government, the issue will have to be met and faced. Whoever it may be, if he fails and pays the price, he will go down in history as one of the world's martyrs.

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The Jardine Engineering Corporation

ONE of the most important and far-reaching events in Far Eastern engineering was the recent incorporation of the Jardine Engineering Corporation, Limited, which succeeds to and takes over the engineering business of Jardine, Matheson & Company, Limited. The engineering department of this pioneer China company was one of the first in the field and many large industrial works and railways in China have been equipped through its agency. Through this department much of the purchasing for the British loan built railways has been successfully conducted, and British engineering interests materially advanced in China.

The complete severance of this department from the main business of the firm and its organization as a distinct corporation has many advantages that will make it a very formidable competitor for future Chinese business. At the reception held on February 23 to mark the opening of the new enterprise, Mr. John Johnstone, the local head of the parent concern, said the idea originated in the fertile brain of Mr. G. S. Aveyard shortly after he joined the firm as head of the engineering department, and although for some time the new company would still be closely identified with Jardine, Matheson & Company, Ltd., steps had been taken to enable it to stand alone when the time became propitious.

The new enterprise in effect, is the first step in a larger measure of co-operation with the Chinese, and at some future date in the not distant future, Chinese would be admitted as shareholders and as co-directors, equally interested in the development of Chinese undertakings for the benefit of the Chinese people.

"Some people," said Mr. Johnstone, "asked why Jardine, Matheson's as a firm had allowed one of their departments to be absorbed into such an undertaking. The explanation was simple. So long as they played at engineering it was possible for Jardine's, who were responsible for the management of the firm, to arrange matters so that engineering contracts and the financing

therefore, did not interfere with ordinary merchant business. It was quickly seen, however, that if they were to take their usual place occupied in most matters connected with China and Chinese business affairs, it would be necessary largely to develop the engineering department with a consequent loss of immediate personal control. His personal opinion for several years past had been that development with Chinese co-operation was to be aimed at. The formation of this corporation was the outcome of views which he was pleased to say were held by all the partners in his firm to-day."

"In conclusion Mr. Johnson said he would like to impress upon those of the staff present the desirability of acquiring a knowledge of Chinese. As employees of that corporation, they would be brought more closely in touch with the natives of the country than most people were and would have a better chance of pulling their weight in the boat. Employees would make themselves indispensable to the corporation if they knew the language."

As the premier British trading concern in China, Jardine, Matheson & Company, through its engineering department, has kept pace in the development of China's industries and contributed largely to bringing the engineering trade of Great Britain with China up to a place second only to the piece-goods business. The British manufacturer undoubtedly holds the lead in many of China's mechanical requirements despite the stiff competition of America and now of Germany and Japan. The future for the expansion of this trade is exceptionally bright. When conditions are once more settled, and British manufacturers are able to quote lower prices and offer longer credits, their percentage of the engineering trade with China is bound to increase. The new company is an exceptionally strong position to obtain its full share of this trade, we congratulate its promotors on its auspicious launching.

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The Hot Springs of Japan

WITH the advent of the vacation season the mind of the sojourner in China and other parts of the Far East turns to where he will send his family for the summer, and to assist him in making a wise choice, the new guide book entitled "The Hot Springs of Japan" has been compiled by Mr. Frederic de Garis, director of publicity of the Japanese government railways. This book is more than the usual tourist guide and becomes a work of reference on the playgrounds of Eastern Asia, including as it does, not only the resorts of Japan, but also of Korea, Formosa and South Manchuria.

The book is written from a foreign viewpoint for foreign readers and aside from the scientific material concerning the analysis of the many medicinal and other springs is most informative and interesting. It lists diseases benefitted and prohibited by the different classes of springs and provides the vacation and health seeker with accurate data on the good resorts where hot spring and sea-bathing may be enjoyed, where cottages can be rented, the names and rates of all hotels and other information invaluable to those preparing their annual vacation budget. In addition, much valuable information is given about the customs of the people, the rules and rates prevailing at Japanese inns, what to bring to supplements the Japanese style of living and what to expect in the way of food, service, etc.

There is also a chapter on radio activity and radium with which many of the springs of Japan are impregnated, explaining their action on the human body and compares them with the principal springs in other countries. The chapter on hot springs near principal cities gives the names of foreign-style hotels and Japanese inns serving foreign food, and another chapter on Japanese inns gives prevailing rates, information about food, tea money, tips to servants, pillows, electric light, police regulations, gifts, customs and inns recommended, in all a most valuable guide to foreigners seeking information that will enable them to select their vacation resort with the least trouble.

Many of these really excellent springs are situated away from the regular routes of travel and are reached from small cities and villages, where the people still retain the simple, courteous charm of ancient Japan, and maintain the old customs of their joyous and kindly race more faithfully than their modernized fellow countrymen in the large cities. And with all this, the foreigner who seeks these springs for a complete change and invigoration of physical and mental powers after the strain of winter's activities, is only a few hours away from the larger cities or the social resorts at Miyanoshita, Nakone, Atami, Kamakura or Nikko.

No country in the world is so blessed with natural hot springs as Japan, and the book lists 951 hot and 155 cold springs, of which 250 have been found to possess radio-activity. Many of these springs are famous for their curative powers and under the careful supervision of specialists and proper publicity, they should in time rival some of the more world famous resorts of Europe, at least, they should attract the people in this part of the world because of their nearby location, facility of access and reasonable charges.

The book is highly illustrated, containing 504 pages, 196 illustrations, two colored lithographs and fifteen specially drawn maps. It slips into the pocket easily, and is sold at seven yen in the bookstores of the Far East.

A Lucky Accident

MANY of the most important discoveries in science and engineering have been made almost by accident. There is now in general use a process known to the textile industry as "wool carbonisation" which is really a method of removing from wool all the vegetable matter, such as straw and burrs, which the sheep may collect in its fleece. A British firm of dyers had provided their workers with overalls of cotton for the summer and of wool for the winter. These overalls got freely splashed during working hours and it was noticed that the dye liquor, which contained acid, soon corroded the cotton overalls, while the wool ones were not affected. To make quite sure of the difference an overall was made with alternate squares of cotton and of wool; and after this garment had been splashed with acid it was found that the woollen squares remained while the cotton ones disappeared. As cotton is similiar in character to the straw, burrs and other vegetable fragments which get into sheep's wool, this firm quickly jumped to the idea that the same process could be used for destroying these foreign materials in wool.

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A New Railway Wagon Brake

THE traditional form of railway goods wagons had a brake lever on one side only, so that the shunter had frequently to cross over the line at considerable risk to get at the lever. Out of this arose a demand for some kind of appliance which would enable the brake to be applied from either side of the wagon; and several solutions of the problem, more or less satisfactory, were tried. The most satisfactory of all appears to be one which has been thoroughly tested on a British railway for the past two years. The brake can be operated by two short hand levers at diagonally opposite corners of the wagons. The mechanism is so designed that the brake is very rapidly and efficiently applied simply by pulling down the lever. Once the brake is set it is practically locked in position and cannot be released until the lever is definitely moved up again. By an ingenious device any wear in the brake blocks is taken up, so that repeated adjustment is not required. Although the pressure which the shunter exerts on the lever is only about sixty pounds, the brake block itself exercises a pressure of six thousand pounds—which is enough to give efficient braking and not too great to produce skiding. This new brake can be adapted to power braking with air pressure or vacuum systems.

Chinese Engineering Development in Shanghai

A Visit to Some Native Machine Shops and Machinery Manufacturers.

SO much has been written about the remarkable progress of Japanese engineering industries that little attention has been focussed on what is taking place along similar lines in China under the very noses of foreigners in such centres as Shanghai, Hongkong, Canton and other large treaty ports. Ten years ago we could count the number of Chinese machine shops in Shanghai on the fingers: to-day it is a most difficult task to list all the establishments that have sprung up in recent years, some of considerable size and merit, but the great majority, small shops tucked away in obscure alleyways where even the Chinese find it difficult to locate them. The rapid development of industrial plants in China and especially in Shanghai during and since the war has brought in its wake a swarm of native engineering works, foundries and machine shops, which, as a rule, commence by engaging in small repair work and soon expand into manufacturers of all classes of machinery, monopolizing the native market for cheap machine tools and special machinery. The correspondent of *The Times Trade Supplement* describing the large number of these small workshops in South China run by mechanics who have "picked up" their knowledge of engineering says:

"These men are not capable of judging the relative value of a good or bad machine-tool. They and their friends have put just enough money into the concern to equip it for repairing steam-launch engines, motor-boat engines, automobiles, etc. Their first thought is to obtain cheap equipment. It is quite obvious that with practically no overhead charges they can undertake repair work at a much lower figure than any European establishment.

These small concerns remind one very much of what was happening in the Midlands in Great Britain fifty or sixty years ago. The beginnings of Birmingham firms, which now possess world-wide reputations, were very inconspicuous. The founder of one of the largest of these machine-tool manufacturing establishments told the writer, some years ago, with justifiable pride, how, after working in a foundry for some time, he and his two mates commenced to do engineering work for themselves in a small tenement dwelling. History is repeating itself in China. There is this difference, however—that the Chinese mechanic can obtain modern equipment for his small works only if he can find the money to pay for it. He usually finds it difficult to raise the money, and that is why he favors the low-priced article."

The same thing is happening in Shanghai where at present there are over 200 machine shops of all kinds, many of them occupying a room or so hidden away in the interior of a Chinese block of buildings and operating a lathe or two and a few home-made machine tools taking in repair work from the many garages and native industrial establishments. Amongst the better class shops which rise to the dignity of engineering works, many are operated exclusively in manufacturing new machinery which, because of its low cost, finds a ready market in the industrial plants of the interior. In fact, many of these new native industrial plants in the interior are equipped throughout with machinery made in Shanghai, especially knitting and weaving works. The list does not stop here, as we find the machine shops in Shanghai turning out every conceivable kind of machinery and machine tools. A visit to these establishments reveals that many large and important machine tools are made in the works for their own use and in many instances orders are being filled for the equipment of new native machine shops in the interior. As an example of this, our correspondent visited the Sin Min Machine Works on Tangshan Road, where a 16-ft. by 20-ft. planer and 12-ft. by 25-ft. lathe of German model were being made to the order of a new native machine shop in Honan, the first in the province. Other shops, such as the Oriental Engineering Works, are making all the equipment for their new and enlarged works under construction. A feature which cannot fail to escape notice, is the employment of boys to operate machine tools, under the supervision of one expert foreman, and in another case a group of girls were being trained to operate machine tools on light work preparatory to their being engaged in a new establishment under a forewomen.

A visit to these various machine shops provides evidence that there are several companies which made good gap lathes, drill presses and planers for rough work, and as pointed out by Mr. Sam Dean of Peking not long ago, they are made so cheaply that they supply practically all the repair shops of the country. It is only in the larger railway shops, and the engineering establishments under foreign supervision that English or American tools are used exclusively.

In commenting on this development Mr. Dean said:

"There is a large and increasing demand in China for machine tools of the repair shop type, but the Chinese have to be educated to the fact that one good foreign tool is worth several cheap Chinese-made machines. Perhaps the most popular American machine tool here is the lathe. This is rather too light for the work it is made to do, but accuracy doesn't matter on the jobs put through in most cases so it does fairly well.

"The expensive machines with gear boxes, electric drives and all that are quite outside the present demand and pocket book. Now and then a large mill will buy good machine tools, but there are comparatively few such mills. However, every city now has an increasing number of small machine shops and this is the trade which has volume and now uses Chinese and Japanese goods. These shops are run in many cases by graduates of Chinese technical schools and Chinese technical schools are mostly equipped with Chinese or Japanese, or at most English-made or German-made, tools. Naturally the students buy for their own shops what they have learned to use. Also the schools with their small incomes buy the cheapest machines.

"Personally, I feel that there are two lines which American machine tool manufacturers could follow in order to get the Chinese market. One is to put their tools in technical schools out here at prices that would enable them to be bought, rather than shoddy Japanese or Chinese machines. The other is to find out the companies that are supplying the Chinese repair shops with machines and in these shops at least work hard to put in American machines. I doubt very much whether we can compete with the Chinese-made machine for the makeshift repair shop, but we certainly ought to be able to furnish the machines that make China's machine tools."

Any attempt to adequately describe the equipment and output of most of these shops is met with at the start by suspicion and it is not always easy to gain admittance. On the other hand, there are many who gladly welcome inspection and who take a pardonable pride in the equipment and work turned out. It was our intention to cover all these establishments so that the readers and advertisers of THE FAR EASTERN REVIEW would receive accurate information about the development of this new industry, but for the present will limit our remarks to a few of the more important that our correspondent was able to visit this last month. The larger foreign-owned and directed engineering works of Shanghai are well known, not only locally, but abroad. The Shanghai Dock & Engineering Company, Ltd., The New Engineering & Shipbuilding Works, Ltd., The Kiangnan Dockyard and the French establishment formerly operated by Nicolas Tsu are well known for the superior quality of their works, ranking with other first-class engineering works at home. There are, however, several smaller works in Shanghai under native supervision rapidly monopolizing a business which must materially affect not only the larger yards but the business of many foreign machinery importers.

Woosung Shops of the China Machine Works, Ltd.

Eastern Engineering and Shipbuilding Company

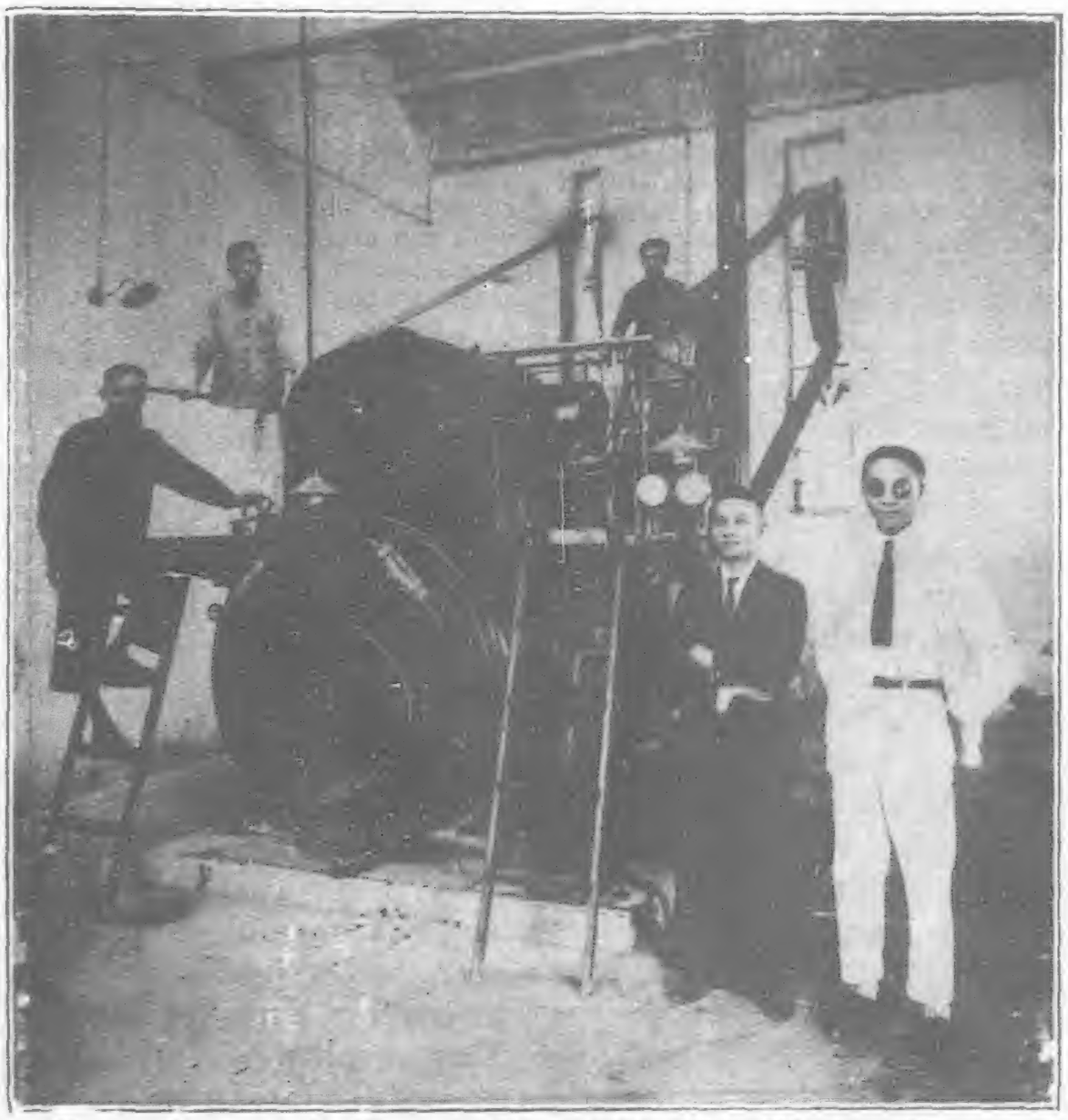
One of the most successful of these smaller establishments is the Eastern Engineering & Shipbuilding Works located at 66 Yangtszepoo Road. Operated as a purely Chinese concern established in 1909 under the name of the Hsing Fay Yung Company, the control passed into the hands of Japanese in 1919 and the works, formerly located on Arsenal Road, Nantao, were transferred to their present site in 1921. A Sino-Japanese concern, the managing director is a Japanese Mr. G. Ono, with a board of directors of three Japanese and two Chinese. It specializes in shipbuilding, in marine engines and boilers, railway and tramway cars and structural steel work.

Machine and Erecting Shop of the Woosung Shops of the China Machine Works, Ltd.

The works cover a large area running from the Yangtszepoo Road to the river on which they have considerable frontage. At the present time slipways are being laid down for the construction of two Yangtze River gunboats for the Japanese government. These are to be 200 feet in length, 30 feet wide, with a draft of 3-ft. 6-in., and a speed of 16 knots, with furnaces adapted for coal or oil fuel. In the past, these works have turned out steamers up to 1,000 tons, amongst which are the two upper Yangtze River light draft steamers, *Hung Fok* and *Hung Kiang* for the Ichang-Chungking service.

The shops are now busy with steel structural work for a new cotton mill, in fact, several such structures have been laid out and made at these works. They have also built twelve first and second-class coaches for the Shanghai - Hangchow - Ningpo Railway, nine passenger cars for the Tientsin-Pukow and four passenger and goods cars for the Nanchang-Kiukiang line in addition to tramway cars for the French and International lines in Shanghai and some tank cars for the Asiatic Petroleum Company.

The foundry of the works is equipped with three cupolas, the largest of ten tons capacity, the blowers being of Japanese make. At present the chief output of the foundry is cast building columns. In the blacksmith shop is found a one ton steam hammer made locally. The pattern shop employs about forty workmen. The machine shop is equipped with 35 tools in all, comprising 17 lathes, 4 planers, 8 drilling machines, 1 milling machine, 2 screw machines and three punching and shearing machines. The largest planner, 14 feet long, 6 feet wide and 4-ft. high was made at the works. The other planers are made by Esterbrooke & Allcard, Sheffield, who also supplied some of the drilling machines. Others drilling machines are from Yamazuchi Katsuzo, a Japanese machine tool maker. The milling machine of American type is also made in Japan, and the two screw machines from Wells Bros., of Greenfield, Mass. The largest lathe is 20 feet long. American, British, Dutch, Japanese and Chinese makers names are seen on different lathes. A feature of these works is the ample space and lighting. The number of workmen employed at present is 150.



Engine Room of the Woosung Shops of the China Machine Works, Ltd.: Equipped with a 95 h.p. locomotive type boiler and engine of German make.

The Oriental Engineering Works

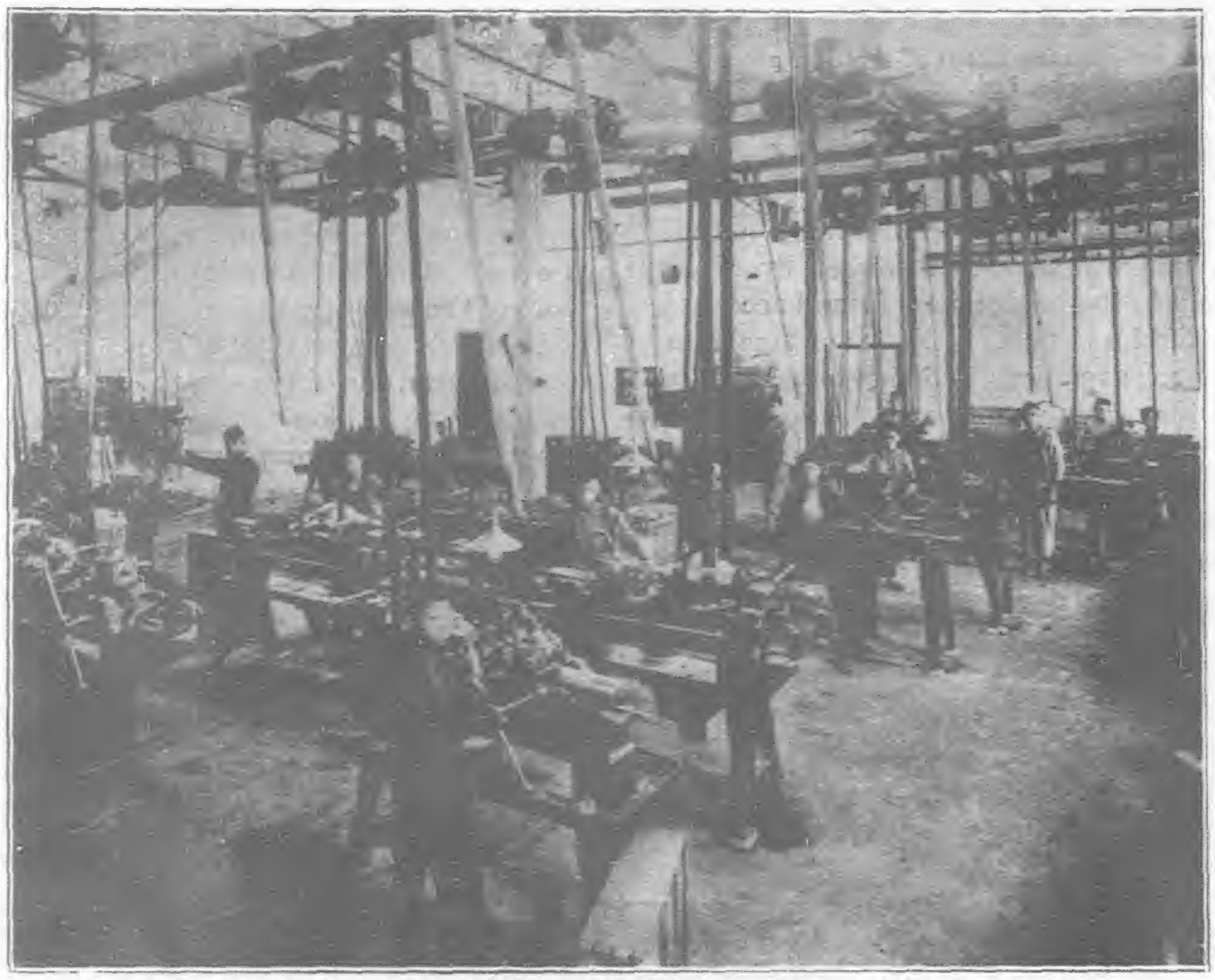
Here is a typical native concern which at present is doubling its capital in order to erect a new establishment three times as large as the present

WOOSUNG SHOPS OF THE CHINA MACHINE WORKS, LTD.

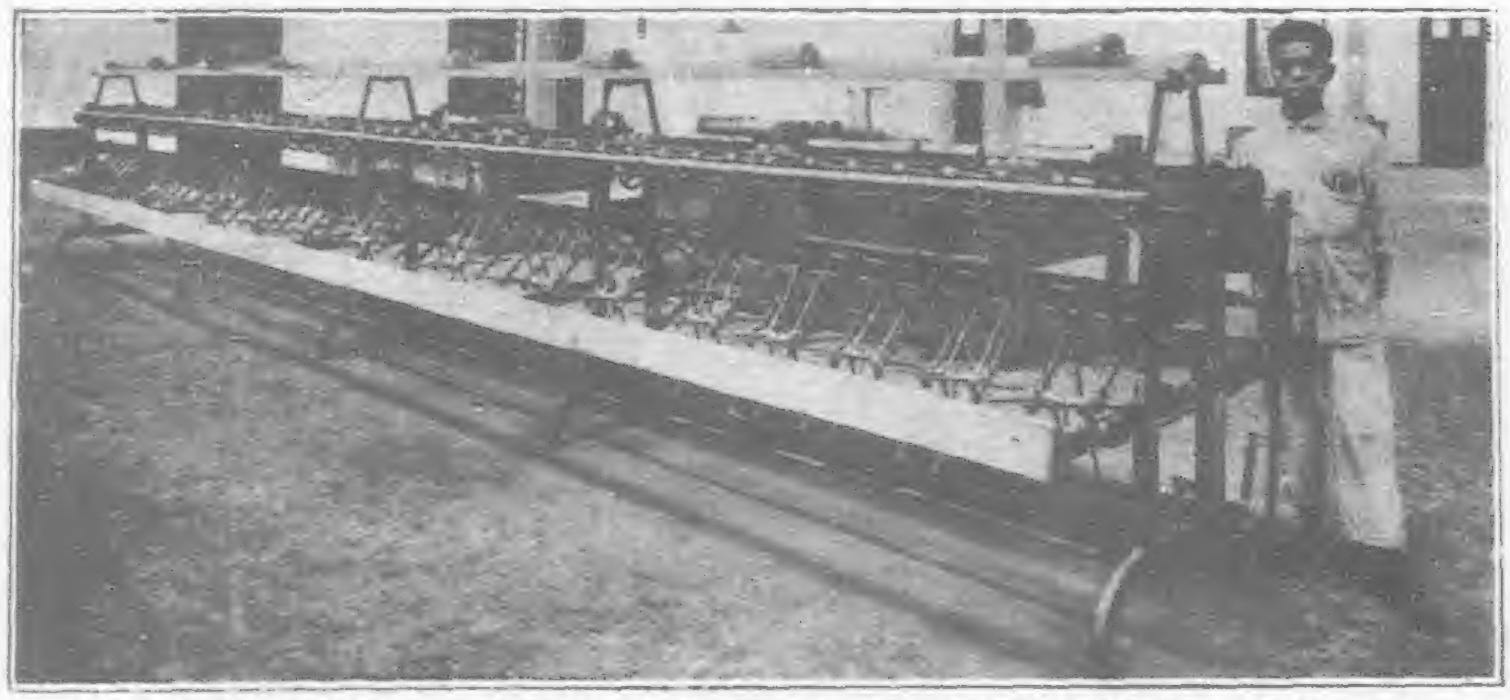
The Foundry **Carpenter's Shop**

one on a plot of land already purchased lying outside the settlement limits in the western district. The offices are located on Pingliang Road. Connected with these are show rooms displaying weaving looms, flat clipping machines, bundling presses, threat twisting machines, double cylinder hydraulic pumps, plummer blocks, vertical steam engines, boiler feed pumps, mill hydrants, water and fire pump standards for street use for the local water company, gallows pulleys, shafting up to 4½ inch, self-lubricating bearings, steam traps, mill gearing, etc., a most comprehensive line of machinery and engineering accessories. The works are located on Dalny Road about five minutes' walk from the office and comprise a foundry and five machine shops.

In the foundry, castings up to 2½ tons, pulleys up to 12 feet and shafting in 24 feet lengths have been turned out. Three of the machine shops are on the ground and two on the first floor of the building. In No. 1 shop is found a 24-foot lathe made at the works with



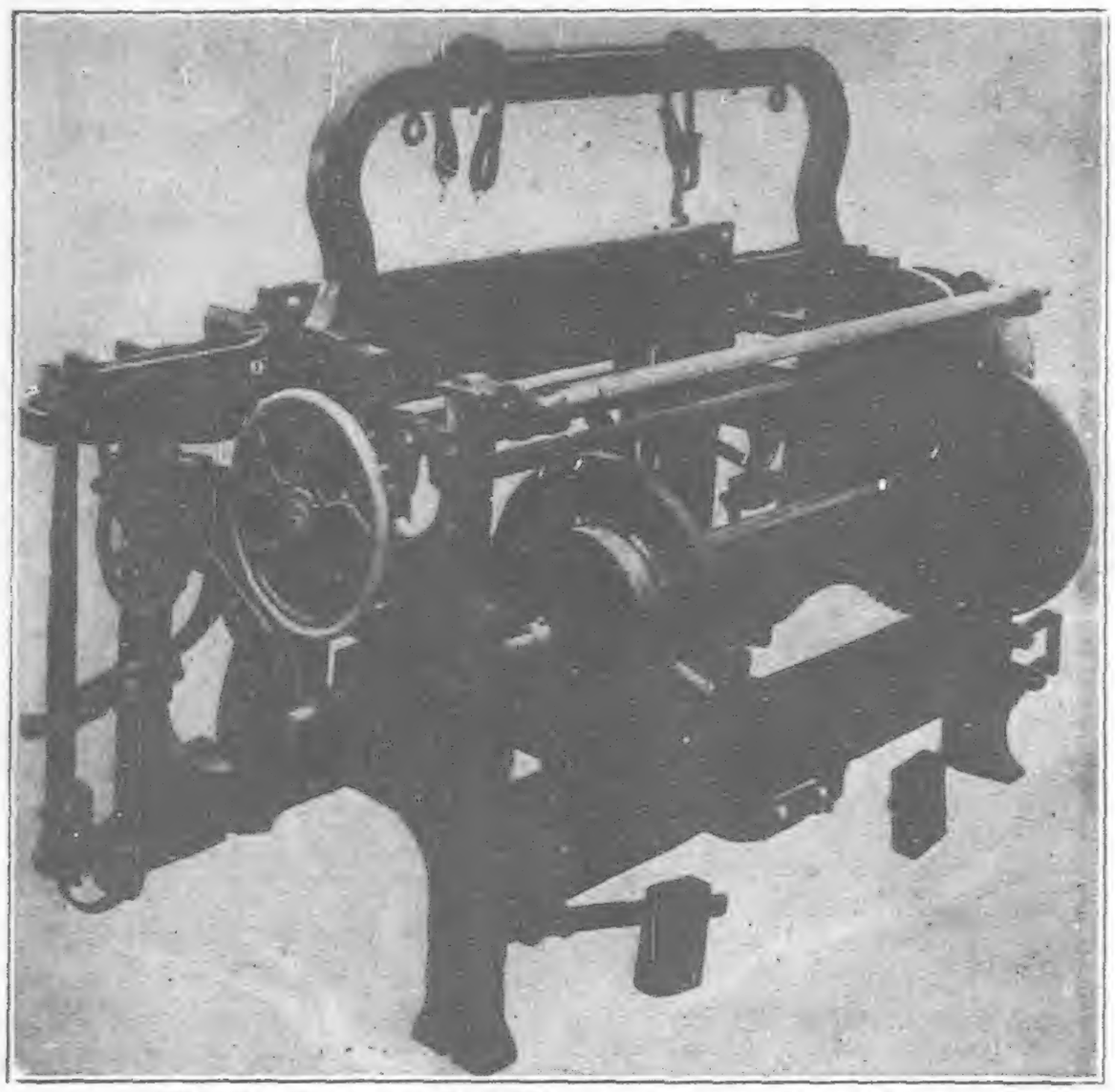
Tool and Spindle Manufacturing Shop of the Woosung Shops of the China Machine Works, Ltd.: Equipped with American and German Lathes.



Silk Winding Machine made at the Woosung Shops of the China Machine Works, Ltd.

thirteen smaller lathes mostly of British manufacture, some German and some American. There is also a milling machine, one shaper, and five drilling machines all British, with two planers, one British and the other, 36 feet long and 5 feet wide of German make. In No. 2 shop are found four German milling and one hobbing machine and ten American lathes of various sizes. No. 3 shop is fitted with three English planers and four drilling machines, six German grinders and two lathes. No. 4 shop with ten American lathes, with the exception of one British slotting machine all the tools in No. 5 shop were made on the works and consist of 24 lathes, nine milling and five drilling machines. In a small room off this shop there are installed two American semi-automatic machines, one a boring lathe with ball bearings and the other a semi-turret head lathe.

Adjoining the main works but with a separate entrance is a second works called the Model Women's Works, established in 1920, where some twenty women, graduates from the



Weaving Loom made at Woosung Shops of the China Machine Works, Ltd.

middle schools, are being trained in the use of machines for making small articles such as screw machine pins, studs, caps for oil cups, etc. When the new factory is ready for operation some time during the present year these women will act as forewomen over a large number of girls to be engaged in the production of small accessories.

A visit to these shops disclosed many varieties of machines in the course of manufacture, such as pulleys, machine tools, hydraulic baling presses to work with the pressure pumps noted above. These baling presses are made in two sizes, one for a pressure of 1,000-lbs. per square inch and the other for a pressure of 2½ tons per square inch. Cloth finishing machines and all the machine tools required for the new works are being made at the present time. These latter now being assembled, include about 40 lathes, 5 slotting and 2 milling machines. The power for the works is supplied by the Shanghai municipal electricity works.

The China Machine Works, Ltd.

One of the most complete and interesting of the native engineering establishments in the Shanghai district is the Woosung shops of the China Machine Works, Limited, located on the Wen Chaopang. The Shanghai offices of the company are located at 112 Szechuen Road. Mr. C. C. Nieh, the well-known Shanghai industrial magnate, is managing director of the enterprise, Mr. C. S. Hau, the manager, and Mr. W. T. Wong, the engineer-in-chief. The latter courteously took our representative through the works and pointed out what they were doing.

The works are located at Woosung thirty minutes by train from Shanghai and two minutes' walk from the station. A siding is to be brought to the works later on. A roofed bay running the width of the factory has been erected for the handling of motor truck loads. The shops with saw tooth roofs are well lighted, having ample space between the machines and scrupulously clean. In fact, it may be called a model factory in many respects. The works were opened in June, 1921, and have been running day and night ever since, shutting down every other Sunday for cleaning. The number of employees is now about 300.

Machine Shop.—In the drawing room, which opens into the large machine shop, ten men are employed. About half the space in the machine shops is free of tools and is used for erecting and assembling, but eventually this space will be filled with tools and the assembling done elsewhere. In the machine shop are found five German Schulte turret lathes (in the tool and spindle shop two more are installed). Each machine has two cutters, 6 to 4 and one 20 m.m. to 40 m.m. There are 30 ordinary lathes in this shop from 5 to 20-ft. in length mostly German with a few American monarch lathes. Drilling machines and radial drills are also German and American make with two gand drillers. In the same shop are two American gear cutting machines, seven American and two German milling machines and one vertical milling machine from Brown & Sharpe Manufacturing Company. Power for the shops is distributed by shafting supplied by a semi-locomotive type 75 h.p. engine made by Henrich Lang of Mannheim. During the visit of our representative, the following machinery was in course of manufacture in this shop: pumps, silk machines, weaving looms, stoves, spindles, cast iron pipe, and bean oil presses. The pump was a positive pressure pump designed to deliver 300 gallons per minute at 160-ft. head through a three inch delivery working at 300 r.p.m.

Tool and Spindle Shop.—In this shop all the tools with few exceptions were manufactured at the works. There are, in addition, two Brown and Sharpe milling machines and one grinder by the same firm also another American grinder and six roto type (German) automatic grinders, specially used for turning out spindles. The machines work to 1/100th m.m. Here are installed also the two turret lathes above mentioned. All spindles are tested to 10,000 r.p.m. on testing frames before being sold.

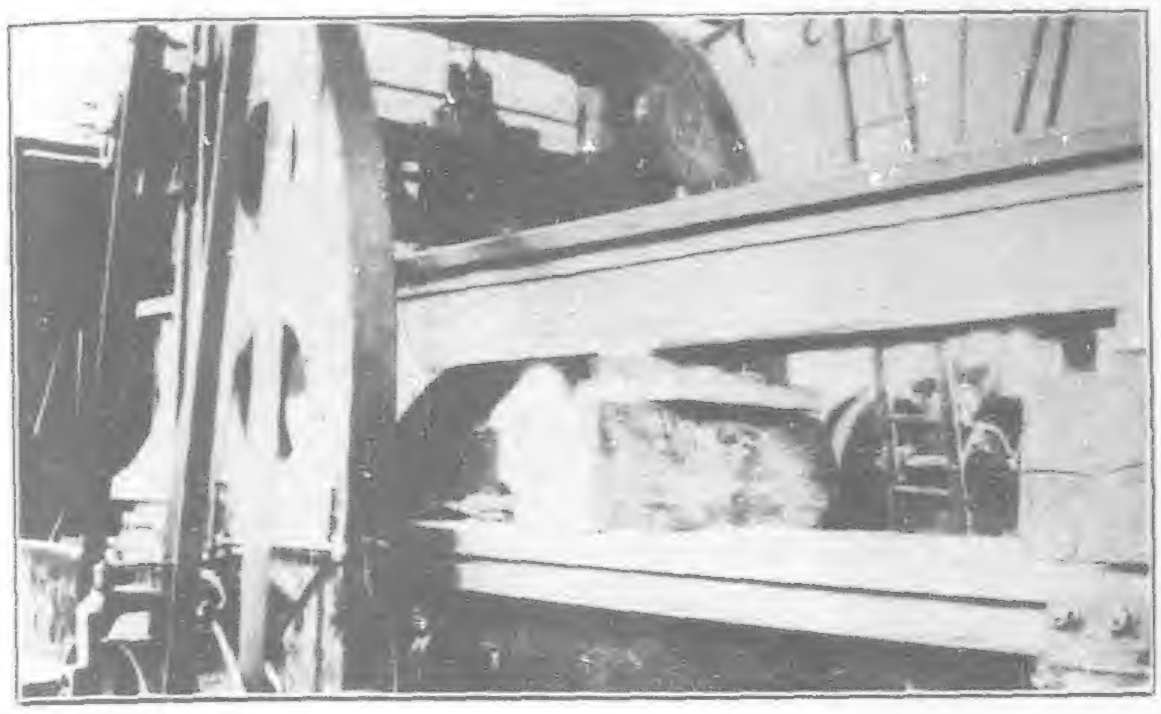
Foundry.—The foundry is commodious and well lighted and is equipped by six American moulding machines, four from Pridmore of Chicago and two from the Arcade Manufacturing Company of Freeport. Three cupolas are used, one with a capacity of seven tons per hour, one of two tons and the other one half ton. A Root's rotary pressure blower, size 4, is installed for the cupolas and an Ingersoll-Rand air compressor working to 80-lbs. per sq. inch for use with the moulding machines. A 56 h.p. crude oil engine provides the power for the blower, air compressor and an 8 k.w. dynamo for lighting. The pig iron used is from the Han-Yeh-Ping Company at Hankow.

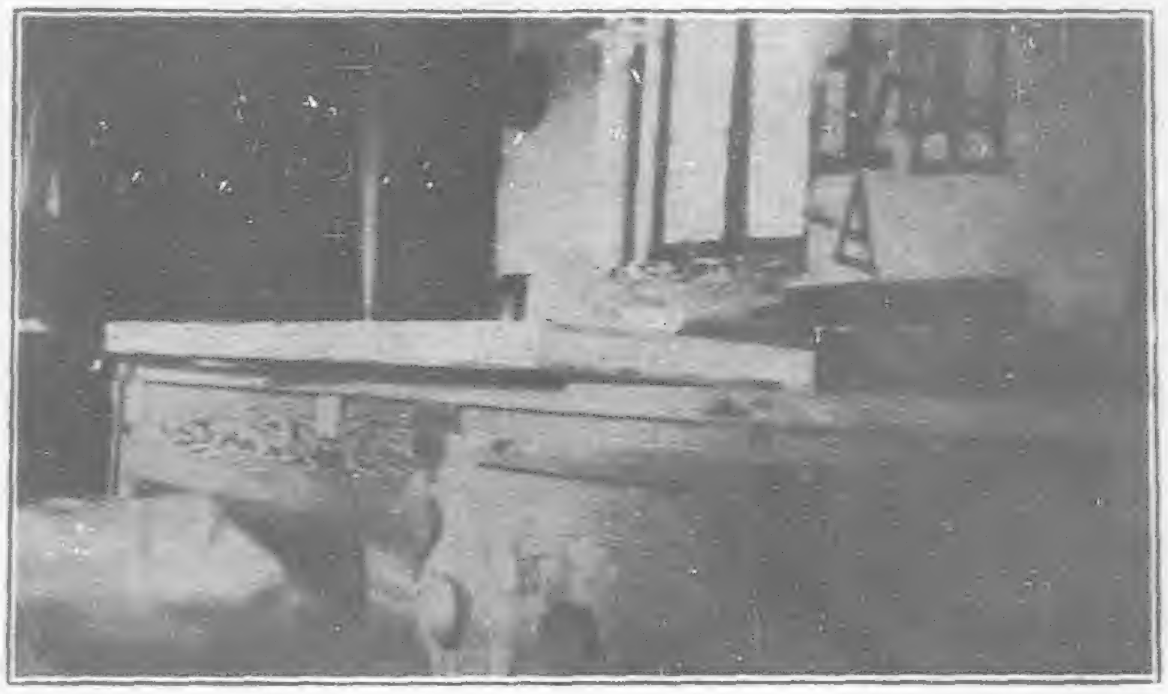
Forge: In the forge is a case hardening stove, a German punching and shearing machine, two power hammers, one German and one American by the Little Giant Company of Mankato, also a blower for the forges. The heating stoves manufactured at the works are for use with hard coal or coke and fitted with a lever regulator to give four heats. Cast iron pipes are made up to 14-in. diameter.

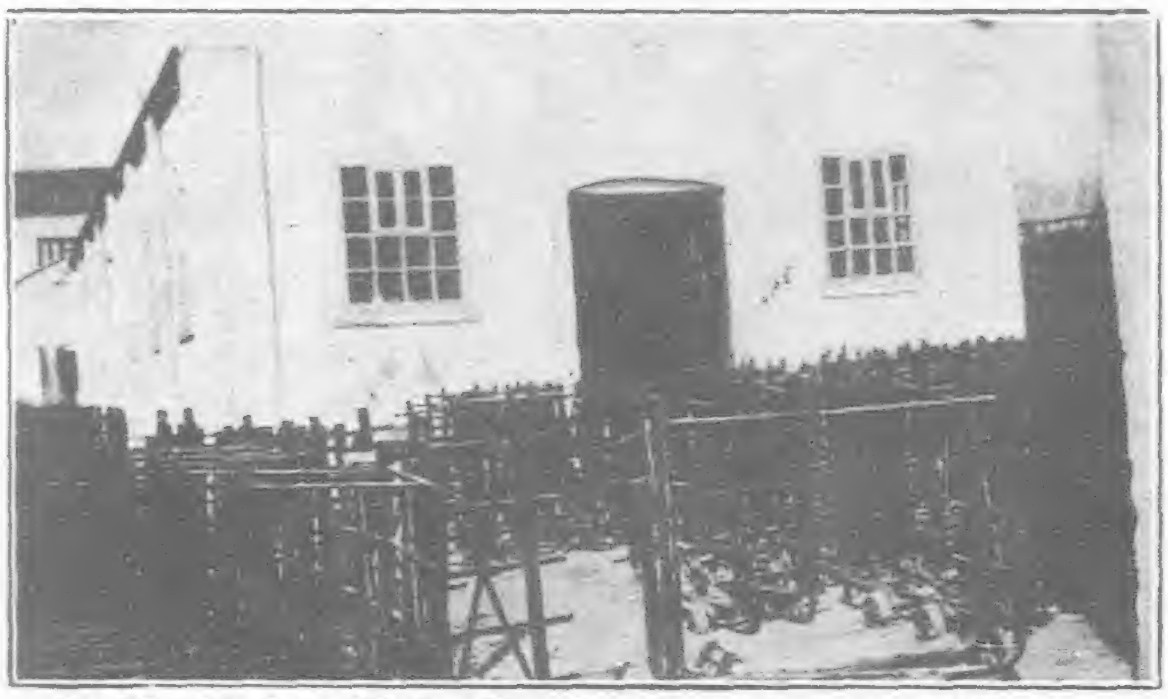
Structural Steel Frame Work for a large Chinese Cotton Mill in which all Columns and Girders were made by the Eastern Engineering and Shipping Company

The belt-driven bean oil presses being made at the time of the visit were destined for Haichow, Kiangsu province, having a capacity of 1,000 piculs per hour.

The factory building is 180-ft. by 300-ft. with all shops under the same roof divided by partitions. The machine shop is 100-ft. by 150-ft.; tool and spindle room, 40-ft. by 125-ft.; foundry, 75-ft. by 120-ft.: forge, 40-ft. by 75-ft.; drawing office, 25-ft. by 60-ft. The balance of the space is taken up with a wood working and pattern shop with a packing room and tool rooms. A house to accommodate 200 workmen is also attached to the works.







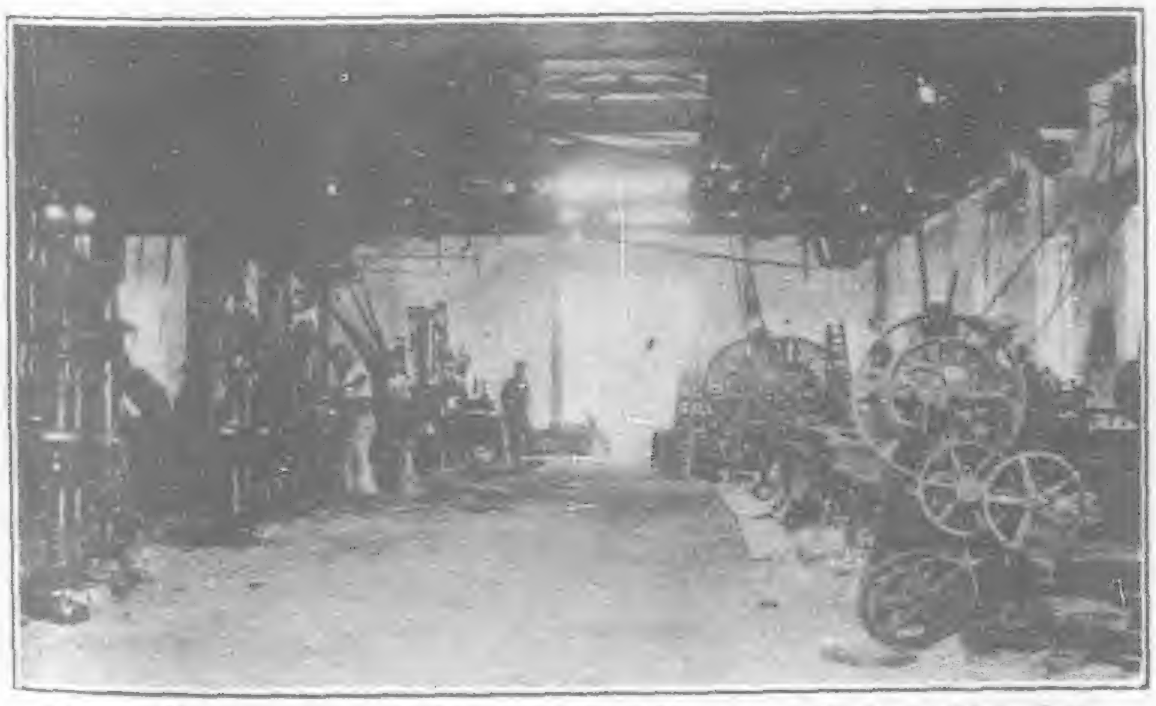
Sin Min Machine Works, Tangshan Road, Shanghai. Top, View of Works: Left, a 16-in. by 20-in. German planer and 12-in. by 25-in. machine lathe being made for a new machine shop in Honan Province: Right, Pattern shop, working on pattern for a 10-in. by 18-in. planer for new Honan shop: Bottom, Trucks for the Shin Ja Brick Works.

These works, owned and operated exclusively by Chinese and catering largely to industrial establishments in which the larger shareholders are interested are an indication of the trend of native engineering progress in China. Here we have an enterprise backed with plenty of capital, large shops, commodious and well equipped with modern machinery, supplying much of the mechanical requirements of Chinese textile mills, together with pumps, oil presses, and other special machines, an enterprise with an established market which in time will undoubtedly expand into a full fledged machinery manufacturing plant.

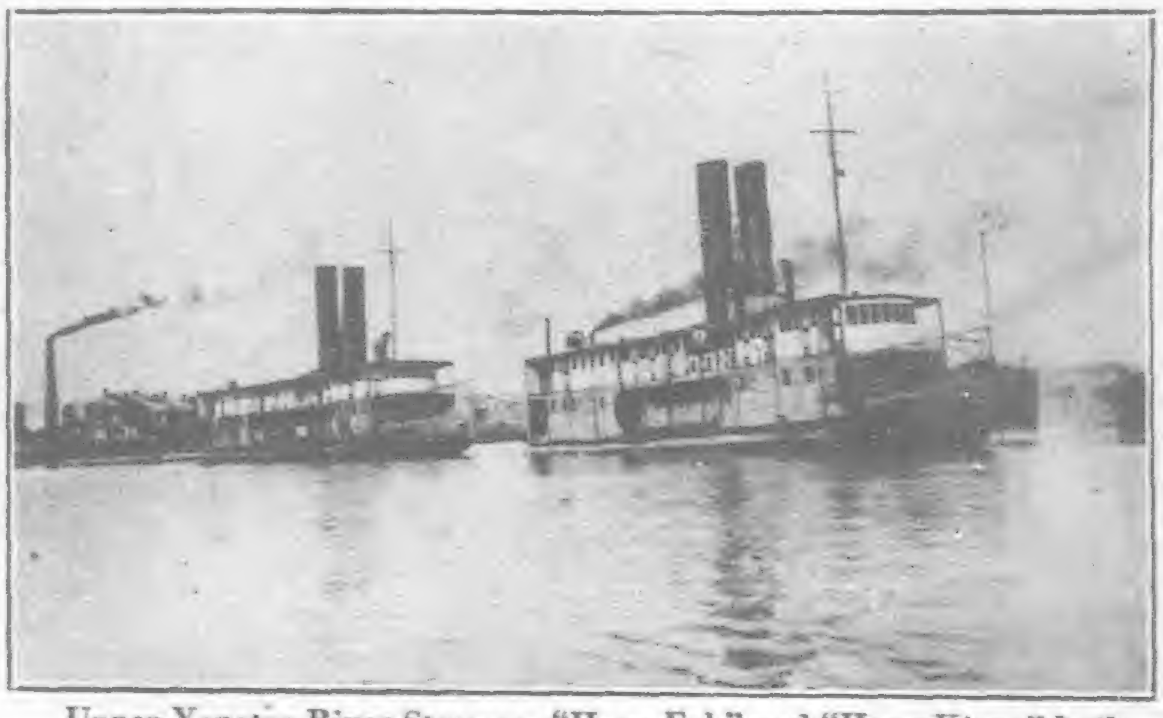
The Yah Dah Iron Works

Somewhat smaller and less pretentious than the former establishments are the Yah Dah Iron Works, established in 1904 by Mr. Zung Tse-chew their proprietor. Although a general manufacturing engineering business is carried on the works specializes in the manufacture of machine tools of all kinds. Although a small factory employing 50 workmen, the tools are kept in constant use turning out tools for other native machine works. All of the tools used in the works were made therein, while those imported are of English and German origen.

There are 16 lathes in use. There is one 36-ft. and another 16-ft. lathe, two milling machines, one planer 10-ft. long by 43-in. wide, and a thread roller planing machine for manufacturing flour mill rollers up to 36-in. long and 10-in. diameter all made at the works for its own use. The total number of machines now installed is 27. A foundry is attached to the machine shop where castings up to four tons are produced. Kerosene engines from 10 to 100 horse-power are manufactured in addition to cotton spinning and printing machinery. Several of the drilling machines, lathes and



Eastern Engineering and Shipbuilding Company Works at Shanghai. Partial View of Machine Shop

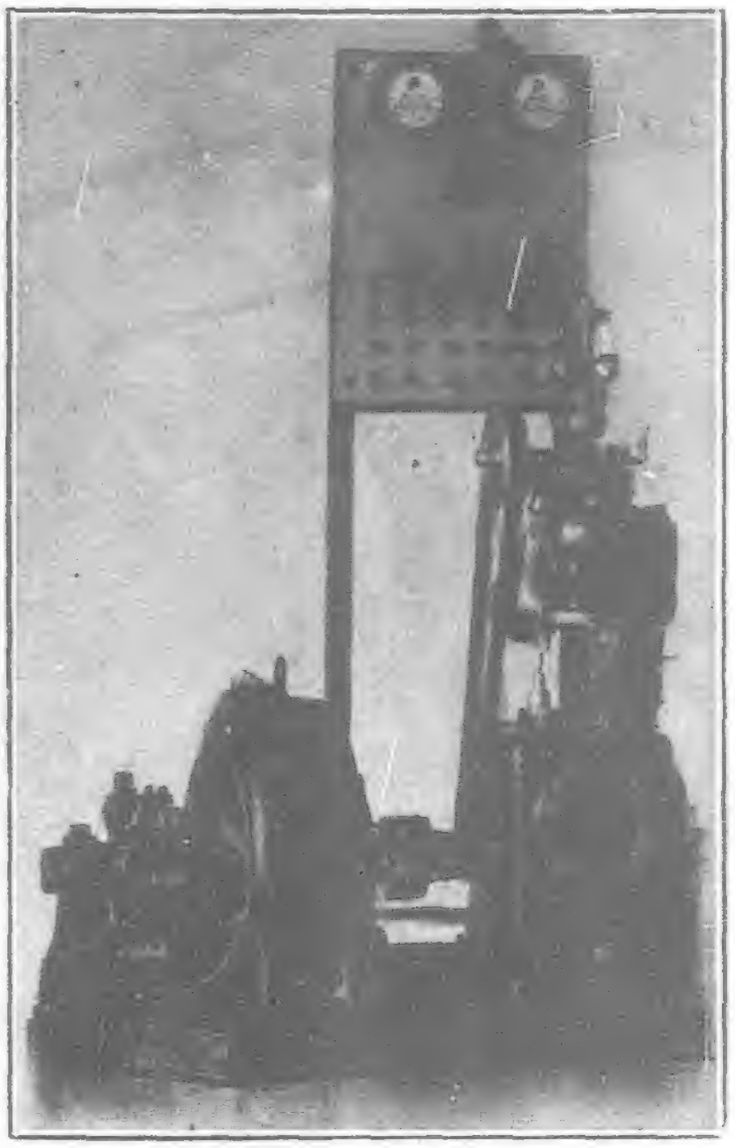


Upper Yangtze River Steamers "Hung Fok" and "Hung Kiang" built at the above Works for the Ichang-Chungking Service

special machinery made at these works are illustrated. Special attention is invited to the lathe which has met with high favor amongst other Chinese machine shops.

The Sin Min Machine Works

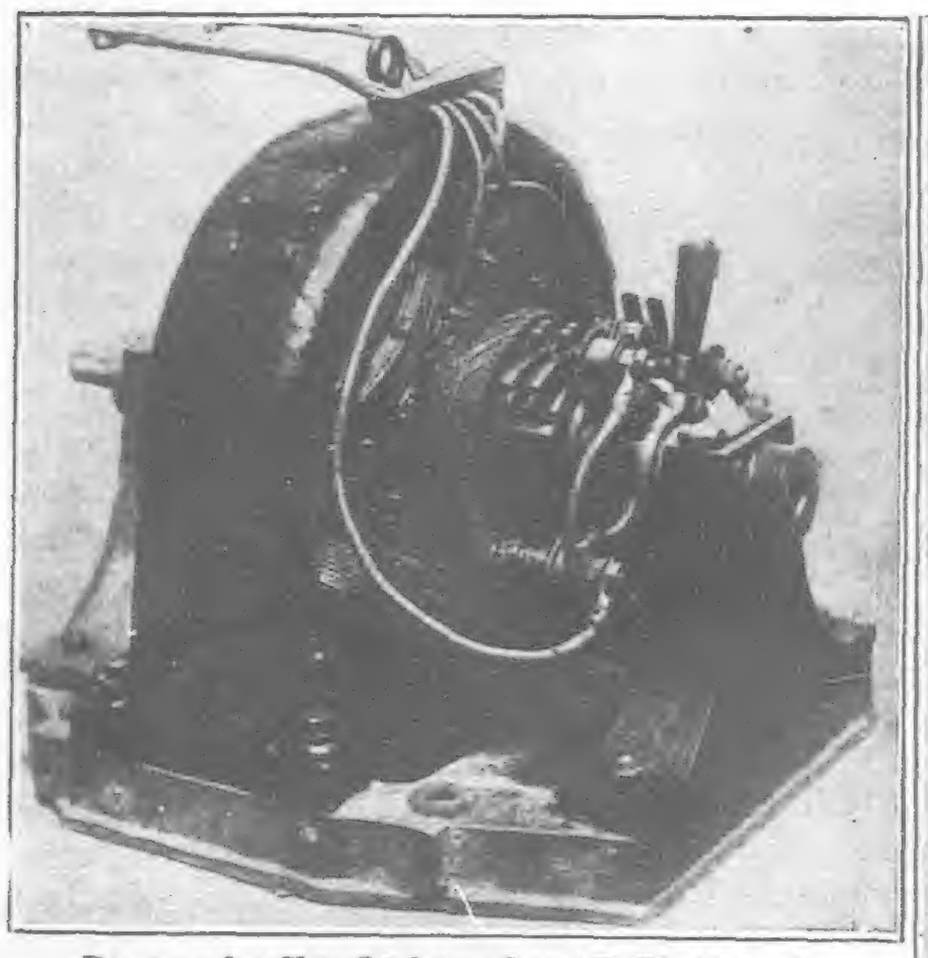
Here we have another new works located on Tangshan Road and with the exception of the machine tools made at the works, it is entirely equipped with German machinery. Being new, the buildings, machine shop, foundry and pattern shops are roomy and well lighted. Mr. C. W. Hu, the manager of the works, is also manager of the Hien Ta Cotton Mill, the Shin Ta Brick Works, which provide the shops with considerable repair work and orders for new equipment. For the brick factory, the Sin Min Works are busy on an order for 400 trucks, turntables, points and a 6-ft. 5-in. diameter belt driven fan. In addition, the works are turning out the equipment for the Kaifeng Machine Works in Honan, the first to be established in that province. This comprises a 18 h.p. horizontal steam engine single cylinder 8-in. diameter and 13-in. stroke for a working pressure of 160-lb. also a German type planer 16-ft.



4 K.W. Generating Set, 750 r.p.m. manufactured by the Wahson Electrical Works for Steamships

operated by Japanese. These works were opened in 1918 at the height of the engineering boom in China, with a capital of Y.200,000 of which Y.120,000 is paid up. Although our representative was not permitted to enter the machine shop, the manager gave him the following data concerning the works:—

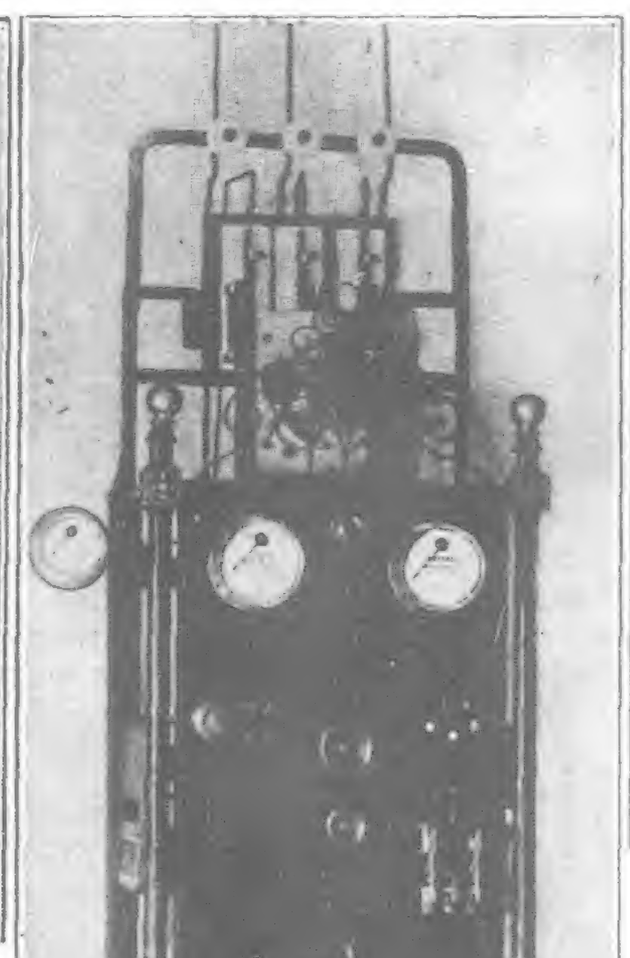
The specialties of these works are the manufacture of tobacco cutting and cotton spinning machinery and mill gearing. Being a Japanese company most of the machines in use are of Japanese make. Fifty lathes are in use a few being American and British, the remainder, Japanese. The largest lathe has a 24-ft. bed. There is also a facing lathe with a 24-in. face plate, both of English make. There are 2 Japanese and 2 English planers, 3 Japanese and 1 American milling machine, 4 Japanese and 1 English shaping machines, 6 Japanese and 2 English drilling machines. The size of the machine shop is 250-ft. long by 50-ft. wide. In the foundry is a one ton cupola with a Root's blower. The pig iron comes from the Han-Yeh-Ping Works at Hankow. Power is taken from the Shanghai municipal electricity department and five motors with a total of 80 h.p. are used.



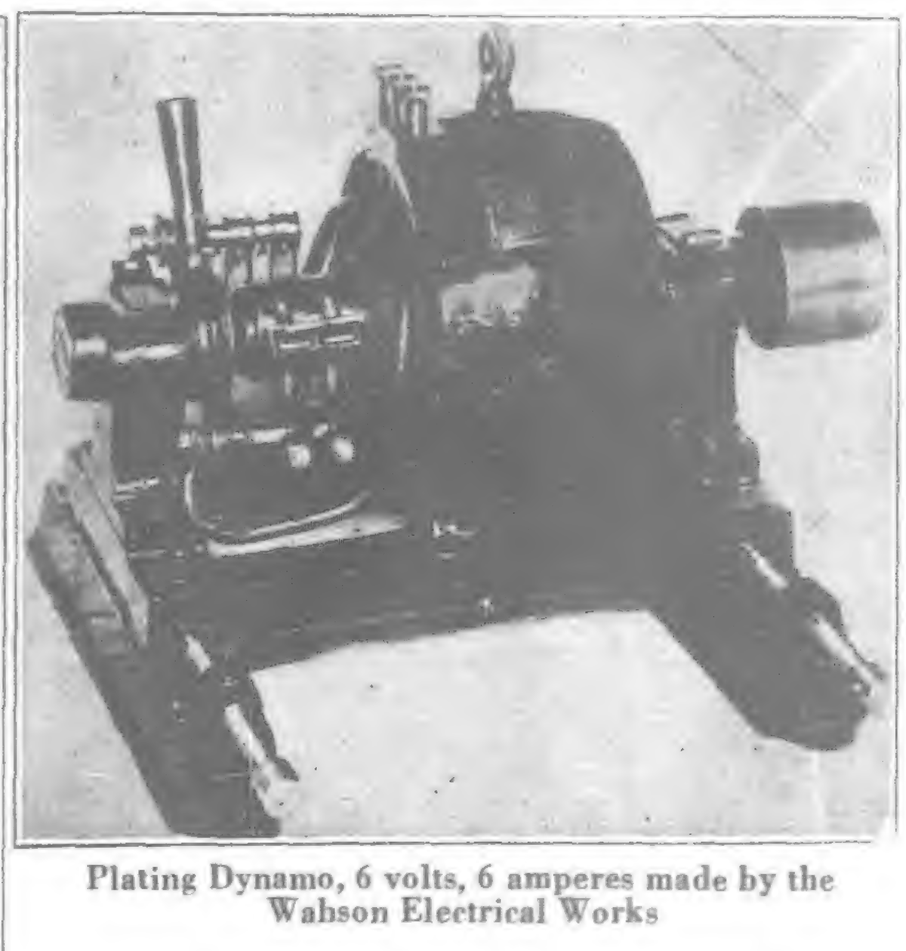
Dynamo for Ship Lighting Set. 4 K.W., 110 volts, made by the Wahson Electric Works

long by 40-in. wide, a lathe 12-ft. long and 28-in. swing. In the pattern shop there was a pattern for a planer 10-ft. long and 18-in. wide. The lathes in the machine shop vary in size from 6-ft. to 12-ft. long. There are also drilling machines up to 1½-in. holes. Six of the lathes are German also the larger drilling machines.

The foundry and pattern shop are in keeping with the other equipment and equally busy. This factory was opened in the early part of 1922 with Mr. B. S. Wong as works manager and Mr. Y. S. Yu as engineer. About 60 workmen are now employed. The illustrations give a fair idea of the work being turned out.



Extra Generator Panel made by the Wahson Electrical Works for the Nanking Electric Light Co.



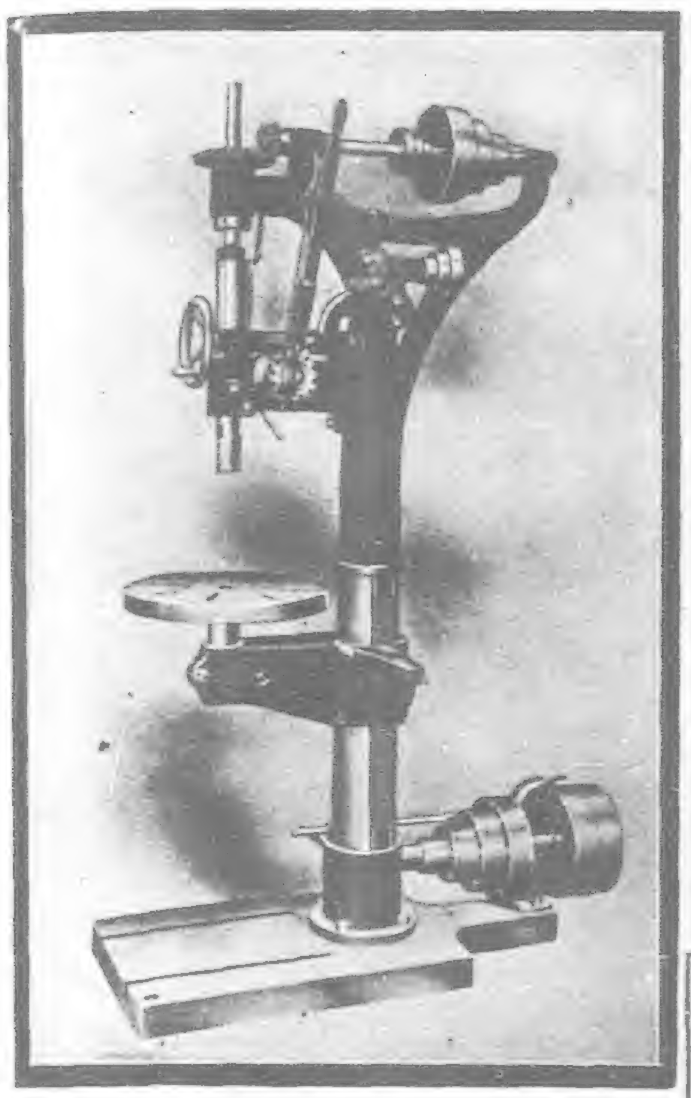
Plating Dynamo, 6 volts, 6 amperes made by the Wahson Electrical Works

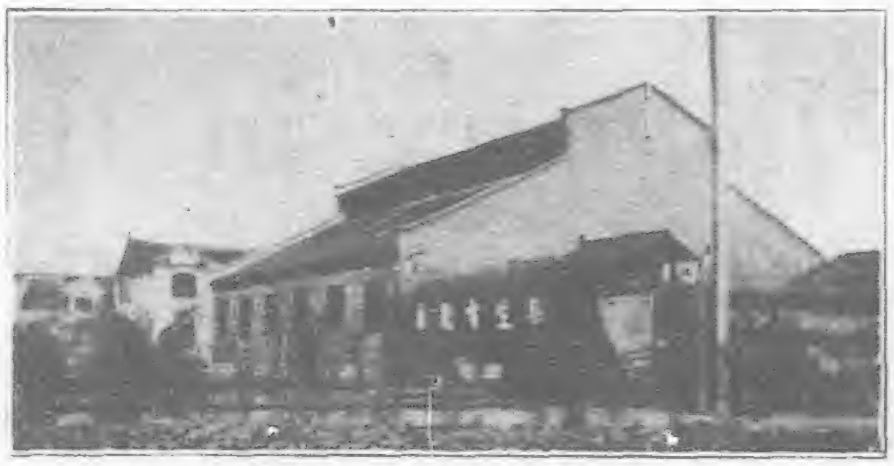
The Wahson Electrical Works

One of the most interesting of the new native engineering enterprises is the Wahson Electrical Works located on East Yalu Road, Shanghai, which commenced operations in 1916, the first electrical manufacturing concern established in China, financed, managed and controlled exclusively by Chinese. The capital invested is $100,000, Mr. Young, the engineer who designed and erected the plant and is responsible for the drawings of new machinery, has never been out of China. Our representative, who visited the plant, is an electrical engineer and he speaks most highly of the quality of the work turned out which include direct current dynamos and motors up to 25 k.w., and direct coupled steam generating sets of 4 k.w. for steamships. One steamship company has been supplied with fifteen of these sets. Oil cooled transformers up to a capacity of 200 k.v.a. made and supplied to various lighting companies. Several of these are now being made to the order of

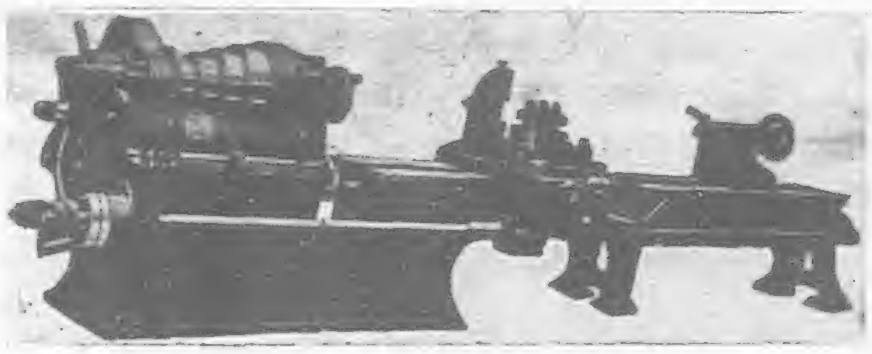
Kung Sing Iron Works

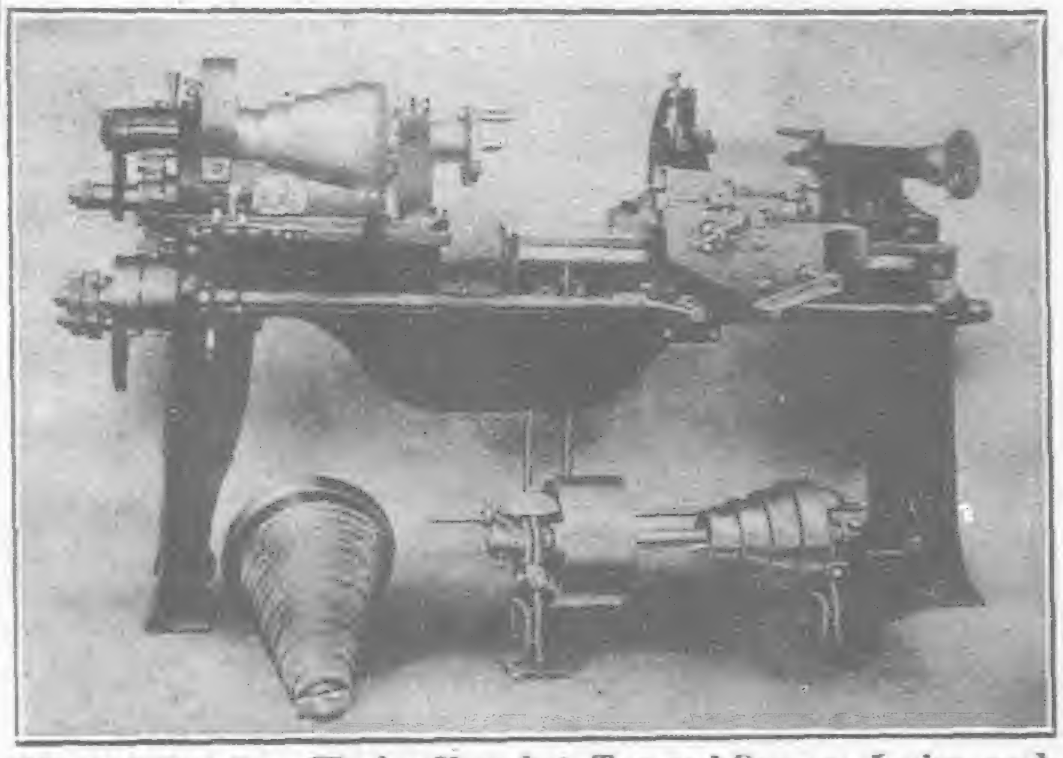
Located on Yangtzsepoo Road or to be more exact No. 18 Thorburn Road, we find the Kung Sing Iron Works financed and



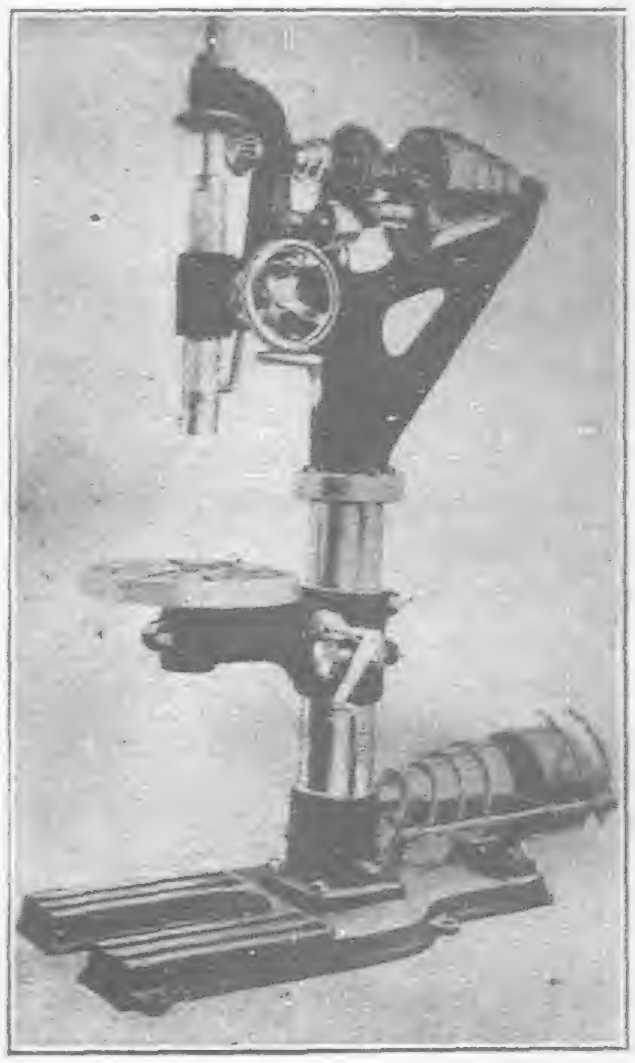


Wahson Electrical Works





The Yah Dah Iron Works, Shanghai. Top and Bottom: Lathes made at the Works: Centre, View of Works: Sides, Types of Drilling Machines made at the Works



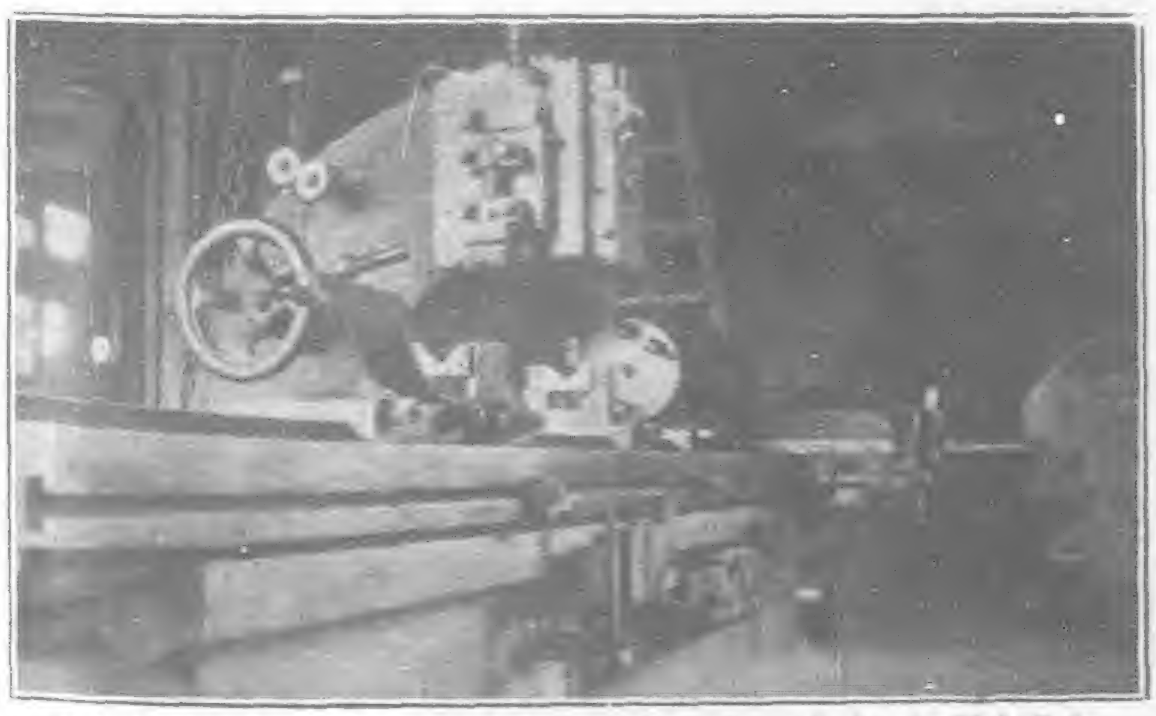
the Changchow Electric Light and Power Company for a primary voltage of 2,200 and secondary of 230 to 400 volts with star connections and with a guarantee of 20 per cent. overload.

High- and low-tension switchboards are made which includes all parts for the front and back of the boards and from measuring instruments to terminals, the only manufactured articles purchased being the angle-iron. One board now being made measures 14-ft. in length and 5-ft. high for a direct current plant also some extra high-tension panels 10-ft. high and 6-ft. wide, the projection from wall being 13-ft. These panels are for the Nanking Electric Light Company. Ammeters and voltmeters for direct and alternating currents are also made and sell for about Taels 17 each. Rectifiers for all ordinary voltages are produced, a very useful type for Shanghai being one rectifying 200 volts a.c. to d.c. at 75 volts and a ten ampere current. About twenty of these have been sold locally at about Taels 45 each largely for electric automobiles.

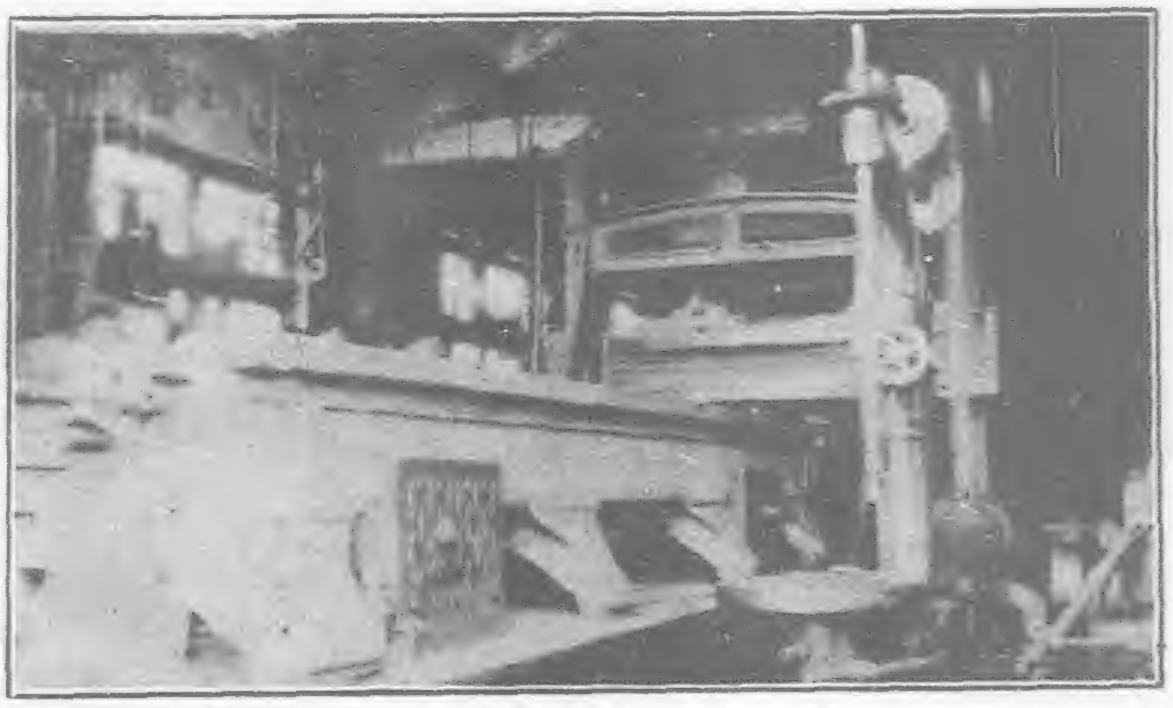
In addition, a neat type of radiator is made in three sizes, 1½, 2 and 2½ kilowatts, the prices ranging from Taels 12 to 30. Current limiters for giving warning when a pre-determined current is exceeded are also made for use on lamp circuits of from one to twenty watt lamps. The price of these is about Taels 4. On the arrival of new machinery from America it is the intention of the works to manufacture kettles, irons and fans.

Amongst the machine tools in the works are seen machines from the American Milling Machine Company and the Carrol Johnson Machine Tool Company, but many of the machines were made by local shops located within a few hundred yards of the works and some by the company itself. As noted extra machine tools have been ordered and when in position fans, cooking and heating utensils will be added to the list of manufactured articles now turned out at these works. Many foreign firms are among the steady customers of the company, and there is every reason to believe that if the present policy is continued its future success is secured.

(*Continued in April issue.*)



13-ft. by 6-ft. Lathe for special flour mill work made by the Yah Dah Iron Works for own use



36-ft. by 5-ft. planer made by the Yah Dah Iron Works for own use

Cement Industry in the Orient

By M. H. Chou, M.S., University of Wisconsin

I. Introduction

(1) Discovery of Cement-Making

THE cement industry is one of the youngest chemical industries in the world. Before its discovery, the calcined lime, clay and sand were used as building materials. When John Sweaton was commissioned in 1756 to replace the earlier Eddystone Lighthouse, he discovered that clayey limestone after being calcined could resist the action of water much better than the pure limestone. This is the real beginning of discovery of cement-making.

(2) Manufacture of Cement

The peculiar property of cement becoming hardened in water makes it an extremely valuable material for construction purposes. Naturally, scientific brains and mechanical genius are called upon to make the best cement at the lowest cost. At the very beginning of cement making vertical kilns are used. The proper proportions of limestone and clay are ground to fine paste and made into bricks which are placed in the vertical kilns for burning, and, after burning, are taken out and ground to powder. This method is called discontinuous. The advantage of this method is saving of fuel, but the disadvantage lies in the slowness of the process and in the high cost of labor for making briquettes. Such a method might be feasible in countries where labor is cheap. Nowadays, this process has been almost entirely replaced by the continuous process which consists of feeding in the slurry to a rotary kiln, and carrying the burned clinker in a continuous conveyor to the compound mill for grinding. This process wastes more coal in calcining, but saves more labor, as the machinery is practically automatic.

(3) Two Processes for Making Cement

There are two main processes for the manufacture of cement—dry process and wet process. Which process is preferable all depends upon the raw materials used. In the United States where there are very rich zones of natural cement rock, especially in the state of Pennsylvania, dry process is extensively used. If the raw materials were clay and limestone, wet process is usually preferred.

II. The Status of the Cement Industry Making in the Orient

When Japan was first opened to foreign trade by Commodore Perry in 1853, she at once awakened to the realization that the key to national strength and prosperity lies in scientific conservation and utilization of national resources. Therefore, she sent many students to the States and Europe to learn the science and art of commerce and industry. Ever since, Japan in Asia, in the development of various industries like ship-building, steel, mines, etc. The same thing is true in the cement industry. The author is grateful to Mr. Van Zandt of the Asano Cement Company for the information on cement mills in Japan.

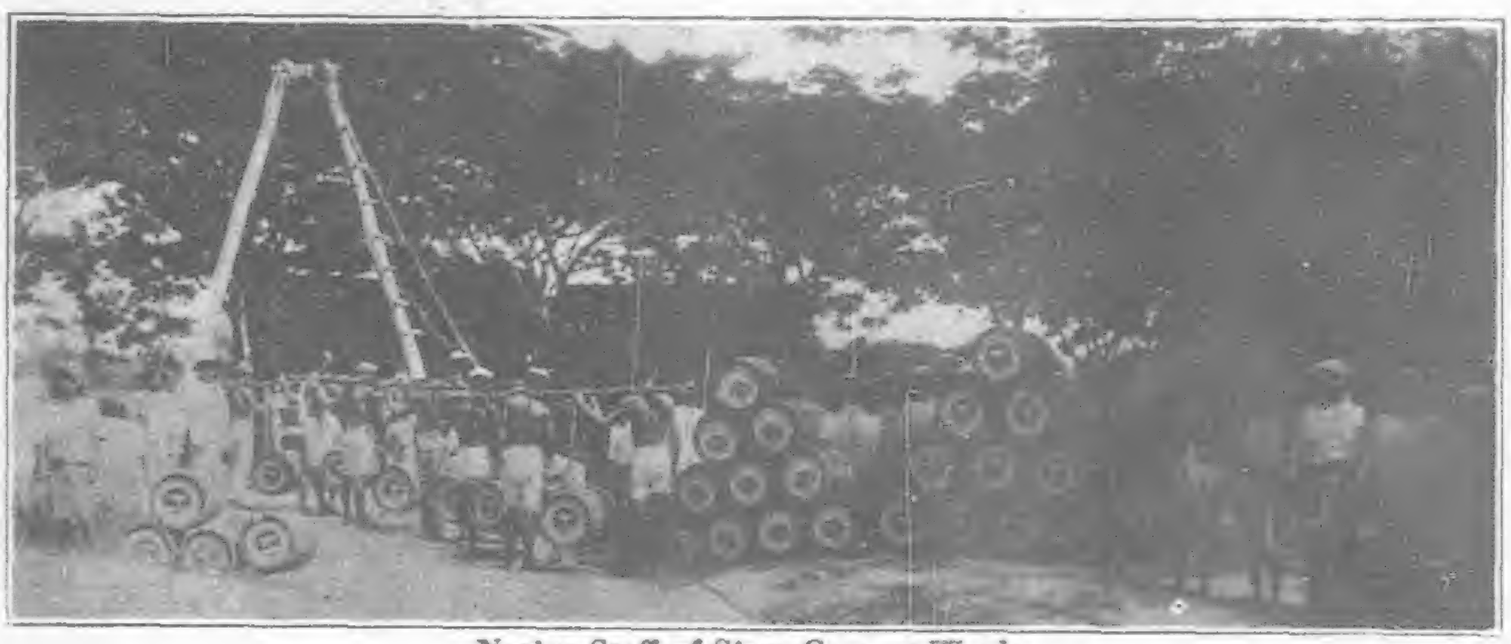
(1) Cement Mills in Japan

Name	Location	Capitalization	Monthly Capacity Barrels
Asano Cement Co.	... ... Tokyo, Moji, Kawahaki, Hokkaido, Formosa	Y 33,000,000	510,000
Onada ,, ,,	... ... Onada, Kona, Manchuria	7,500,000	150,000
Kokuka ,, ,,	... ... Karita	5,000,000	75,000
Miye ,, ,,	... ... Yamada	4,000,000	15,000
Iwaki ,, ,,	... ... Yatenkura	3,000,000	30,000
Aichi ,, ,,	... ... Nagoya	3,000,000	30,000
Oita ,, ,,	... ... Oita	3,000,000	25,000
Nippon ,, ,,	... ... Yatsushiro	2,600,000	50,000
Tosa ,, ,,	... ... Kochi	2,000,000	30,000
Nagoya ,, ,,	... ... Nagoya	2,000,000	20,000
Toa ,, ,,	... ... Amagasaki	1,500,000	18,000
Kitzu-gawa ,, ,,	... ... Asaka	1,400,000	25,000
Chuo ,, ,,	... ... Kurosaki	1,000,000	20,000
Asahi ,, ,,	... ... Wakayama	1,000,000	15,000
Teikoku ,, ,,	... ... Kumamoto	1,000,000	(building)
Saga ,, ,,	... ... Saga	800,000	20,000
Asaka Yogyo	... ... Asaka	4,000,000	30,000
Sakura ,, ,,	... ... Aita	800,000	20,000
Hinode ,, ,,	... ... Aomui		
Suzuki ,, ,,	... ... Tokyo		15,000
Neppen Chisso Cement Co.	... Mizumata, Kagomimachi		25,000
Denki Kagaku Kogyo Cement Co	Omuta		15,000
Mikana ,, ,,	... ... Taharamochi	500,000	5,500
Yashikawa ,, ,,	... ... Okayama	200,000	2,000

There are altogether 24 cement plants in Japan most of which are turning out 500 barrels a day. There are three mills producing 1,000 barrels daily. The Onoda Cement Company, the oldest in Japan, has three modern plants located at Onoda, Japan, in Korea and in Manchuria. It has the total capacity of 5,000 barrels a day. The new Hokaku Cement Co. is the second largest, producing 2,000 barrels a day. The Iwaki, Aichi, Oila, Tosa, Kidzugawa, Asaka, Yogyo plants are producing 1,000 barrels of cement per day.

The production of cement in Japan at present is five million to six million barrels a year, of which ten per cent. is exported and 90 per cent. consumed at home. The government railways are the largest consumer of cement in Japan. The production capacity of cement in Japan was doubled during the war and the normal increase of consumption of cement is ten per cent. annually.

The domestic price of cement in 1907 was 4.5 yen but increased to 12 yen in 1921. The export price of cement in 1912 was 5 yen and increased to 7 or 8 yen in 1921.

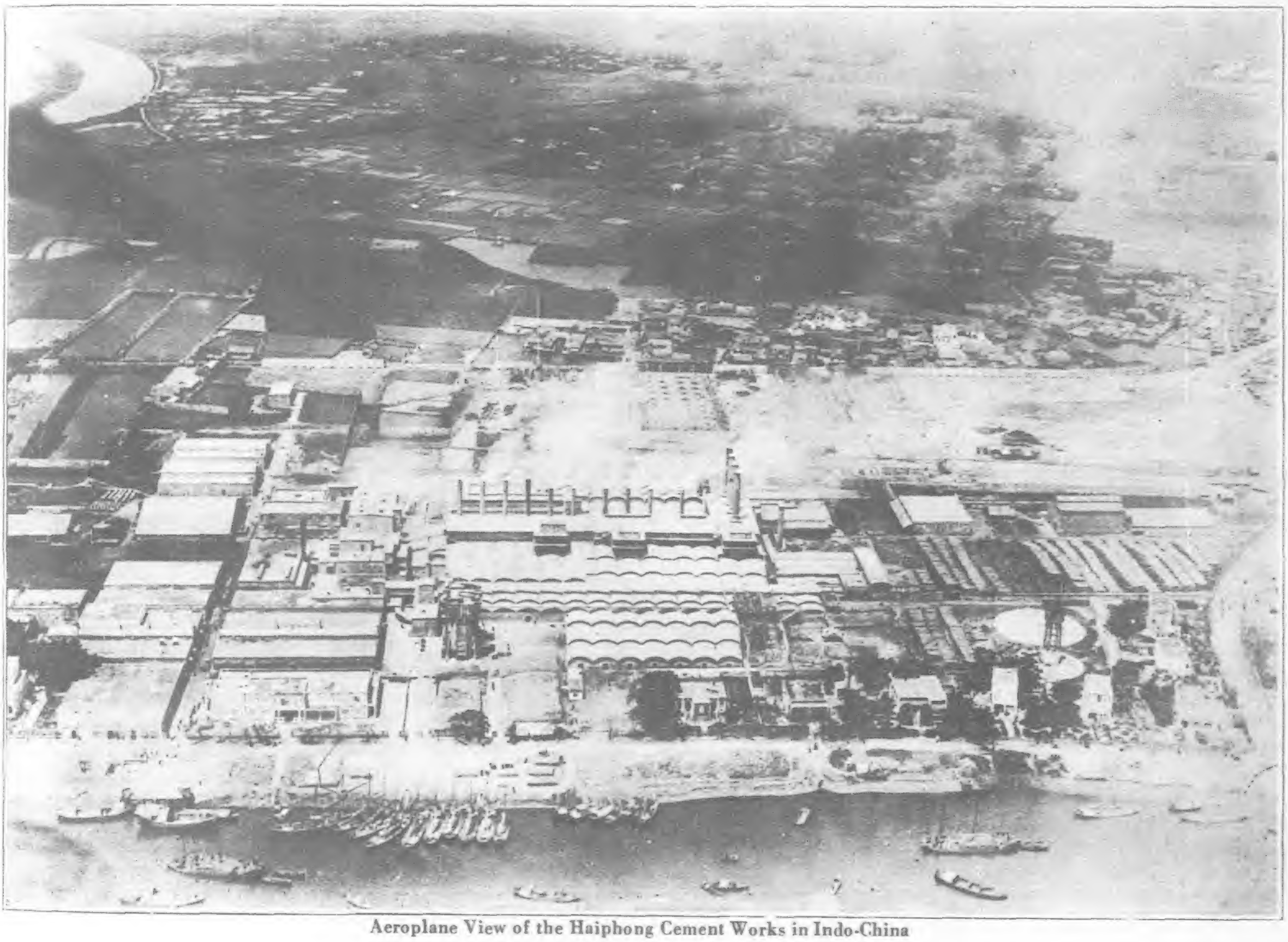


Native Staff of Siam Cement Works

The Japanese export trade of cement to other oriental countries is as follows :

Year	North China Bbls.	Yen	Kwangtung Bbls.	Yen	British India Bbls.	Yen
1917... ...	35,950	5.12	62,700	5.47	83,400	5.16
1918... ...	36,000	6.33	185,500	6,60	110,000	7.09
1919... ...	65,600	6.33	414,000	6.55	92,700	6.52
1920... ...	79,750	8.96	161,600	7.52	134,800	8.75
1921... ...	75,000	6.64	179,000	7.39	122,100	7.44

Year	Straits Settlements Bbls.	Yen	Dutch East Indies Bbls.	Yen	Philippine Islands Bbls.	Yen
1917... ...	44,700	5.26	263,000	4.85	23,850	5.24
1918... ...	106,200	6.50	385,000	6.59	82,700	6.34
1919... ...	47,000	6.51	243,500	6.63	131,000	6.19
1920... ...	63,700	8.97	426,800	9.38	388,000	8.38
1921... ...	14,280	7.22	312,000	7.01	159,500	6.68



Aeroplane View of the Haiphong Cement Works in Indo-China

(2) Cement Plants in India

The following is a list of cement plants operating in India :—

Name	Location	Capacity
Dwarka Cement Co. ..	Dwarka	50,000
Katni ,, ,, ..	Katni	16,000
Bundi ,, ,, ..	Lakheri	13,000
Indian ,, ,, ..	Por Bander	10,000
Madras ,, ,, ..	Madras	5,000

The largest producers in India is the Dwarka Cement Company. It has two rotary kilns. All the machinery is of American-make. The next in size are the old plants, Katni Bundi and Indian. The total output is not sufficient to supply the local demand. A considerable quantity is imported from the United States and Germany. The consumption of cement in India is one million barrels a year. To meet this demand, four new cement plants are being built.

Name	Location	Capacity
Gwaloir Cement Co. ..	Gwaloir	25,000
Central Prornicle Co. ..	Inbblepore	50,000
Photas Cement Co. ..	Ribar State	——
Inbblepore Cement Co. ..	Inbblepore	——

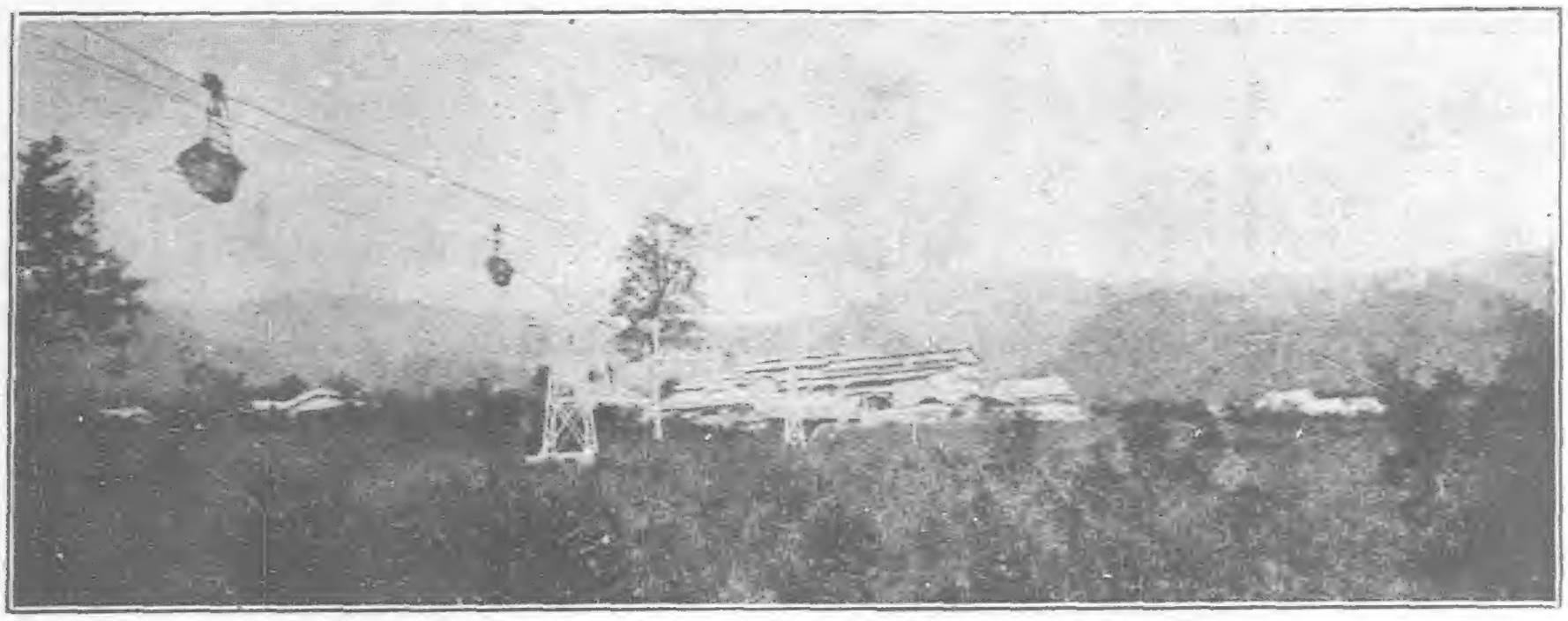
(3) Cement Plants in the Philippine Islands

The Rizal plant in the Philippine islands of 500 bbls. capacity was built by the Krupp Works of Germany and operated for two years. Lime rock and " tufa " were used as raw materials. The operation was stopped due to the difficulty in transportation which rendered the cost of manufacture excessive.

Another new plant of 800 to 1,000 barrels daily capacity has been started in Cebu. The machinery is entirely of American make and erected by the National Security Cement Company of the United States. It is largely owned by the government. The greatest drawback against the cement industry in the Philippine islands is scarcity of fuel. Crude oil from Borneo may be used for firing the kiln of the cement plant at Cebu.

4. Other Far Eastern Cement Plants

Name	Location	Monthly capacity
Batu Caves Cement Co. ..	Butu Caves, F.M.S.	15,000
Padang Cement Co. (owned by Dutch)	Padang, Sumatra	20,000
Siam Cement Co.	Bangkok, Siam	13,000
Onoda Cement Co. (owned by Japanese)	Dalny, Dairen (Japanese Leased Territory)	



Plant of the Netherlands Indies Cement Company, near Padang, Sumatra

III. Detailed Survey of Cement Industry in China

(*a*) Cause of Slow Development of Cement Industry

Cement is not so extensively used in oriental countries, because the people have not been so advanced in scientific education as those in the Western countries. There are many factors responsible for the slow development of cement industry in China; the principal ones are as follows:

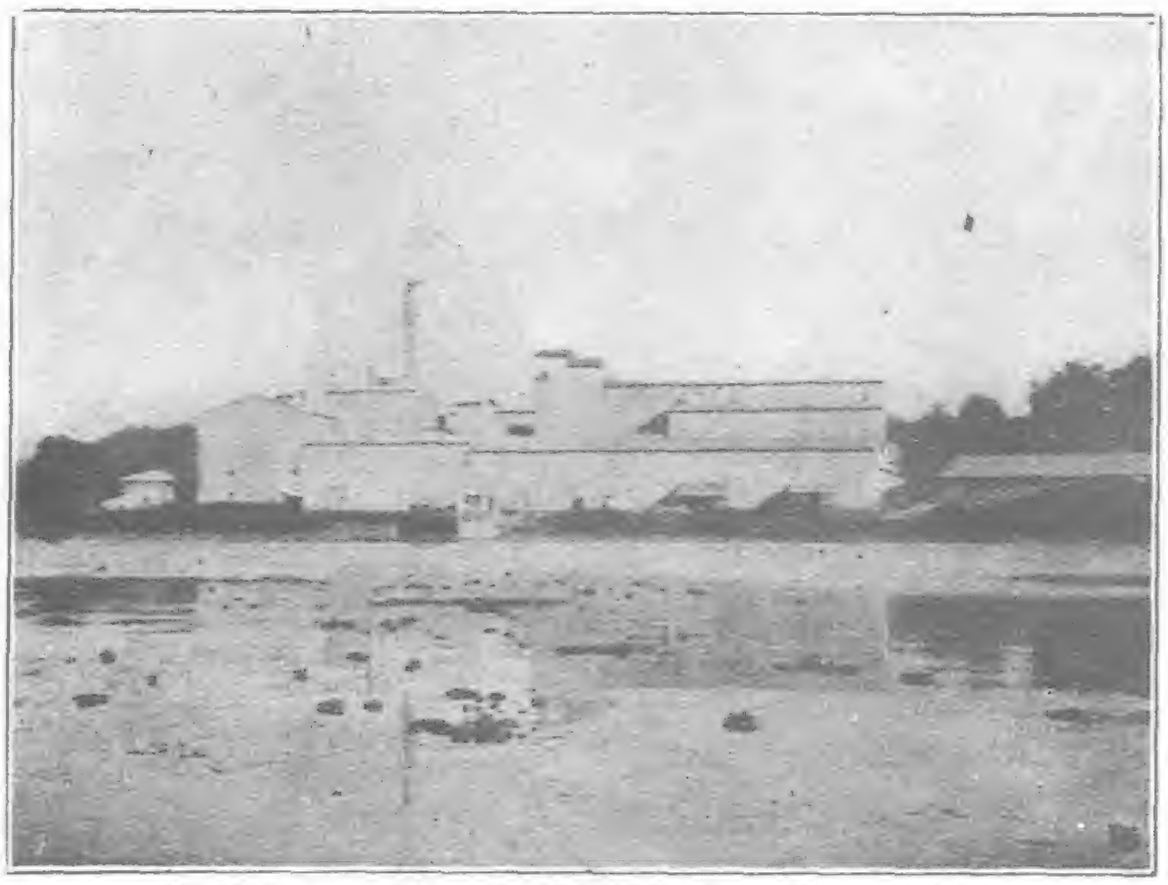
(1) Superstition, ignorance and conservativeness of the people.

(2) *Laissez-faire* policy of the government, both national and municipal.

(3) Slow development of industries and commerce.

(4) Lack of enterprising spirit and proper knowledge to finance big capitalized schemes.

The cement industry needs big capital and the stock company for financing is inevitable. But the latter system is an innovation to the Chinese people who hesitate to invest their surplus money in such companies whose mismanagement by unscrupulous persons causes failure as was seen in the 150 stock exchanges last year which, with few exceptions, were nothing but wild cat gambling places. The closing of over 100 stock exchanges during 1922 dealt almost a death blow to the enterprising spirit of small investors. Consequently, this bad example has retarded the development of legitimate industries like cement, porcelain, machinery, glass, paper, etc. This briefly summarizes the industrial situation of China to-day.



Rizal Cement Plant in the Philippines, Closed Down

(*b*) Cement Used in China

The cement consumed in China is partly supplied by Japan, Italy, Germany and partly by the cement plants in China and adjacent territories.

Cement Plants in China Proper

At the present time there are four cement plants operating in China.

(1) Chee Hsin Cement Co. (Ltd.), Tongshan, Province of Chihli.

(2) Tayeh Cement Works, Province of Hupeh.

(3) Shantung Cement Works near Tsingtao, Province of Shantung.

(4) Canton Cement Works, Canton, Province of Kwangtung.

Cement Plants in Adjacent Territories

(5) Kowloon Cement Works, Hongkong, Leased Territory.

(6) Green Islands Cement Works at Macao.

(7) Ho Hong Cement Co., Singapore, Straits Settlements.

(8) Haiphong Cement Works, Tongking, Indo-China.

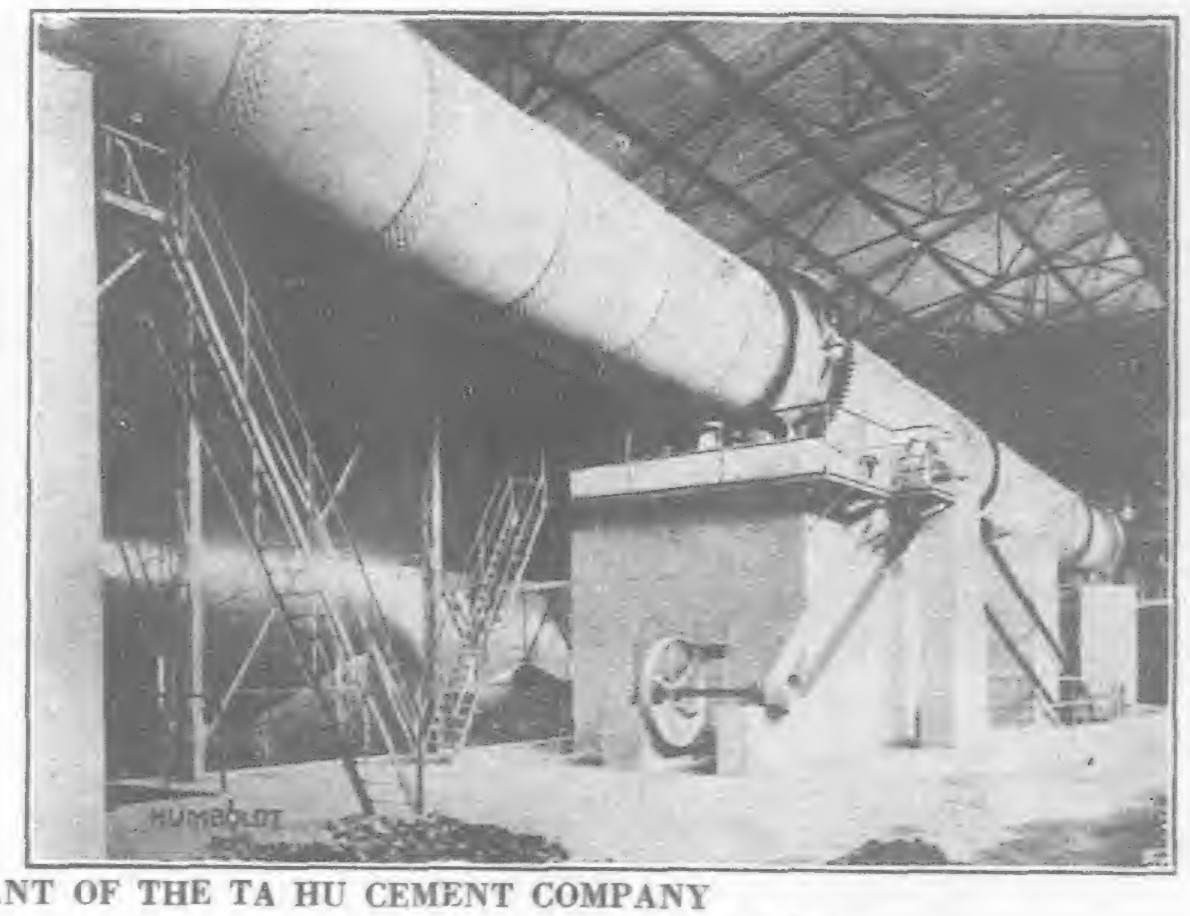
Chee Hsin Cement Works

The plant is located at Tongshan, province of Chihli, on the Peking-Mukden Railway, 74 miles northeast of Tientsin and 91 miles by rail from the port of Chinwangtao. The works were formerly owned by the Kailan Mining Administration whose nearest coal colliery is about one mile from the cement plant. Later, the plant was sold to the Chee Hsin Cement Company.

The raw materials used—limestone and clay—are located under the plant. The coal is from mines of the Kailan Mining Administration. A small amount of gypsum from South-central China is added to the finished product to prolong the setting time of cement.

The mill building is of brick and consists of two plants, which have two units each. The older plant with machinery driven by

The Onada Cement Plant at Choushuitzu, near Dairen



HUMBOLDT MACHINERY IN THE NEW PLANT OF THE TA HU CEMENT COMPANY

Kiln House with Traveling Cranes **Electric Rotary Kiln**

Coal Mill

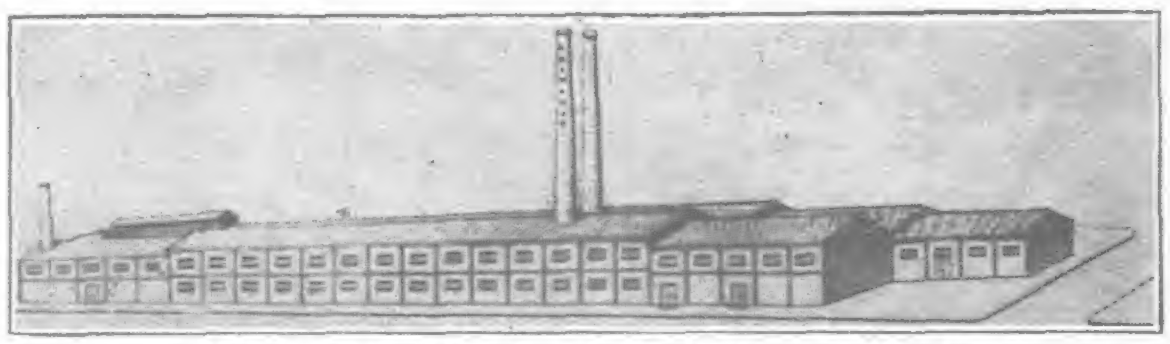
limestone is roughly crushed to the size of two inches and then mixed with slurry and grounds in short ball mills, using steel balls. The mixture passes to tube mills for final grinding and then into slurry tanks where samples for analysis are taken, then the slurry is fed into rotary kilns of 100-ft. long. The clinker comes out in air-cooled steel kilns.

The Chee Hsin Co. also owns a small brick plant near the cement works and a tile and pottery plant which turns out sewer pipes, cuspidors, toilet articles, electric porcelain and other heavy stoneware.

Tayeh Cement Works

The Tayeh Cement Works, erected in 1910, is situated at Shi Hui Yao village in the Hupeh province. The machinery was supplied by the firm of Arnhold, Karberg & Co. It was operated for four years at a loss of 850,000 taels, when it was bought by the Chee Hsin Cement Co., Ltd., and operated under the new name of the Hwa Chi Hupeh Cement Works Co. and capitalized at 1,000,000 taels.

Suitable limestone and clay are abundant in the vicinity of the plant. The coal used is brought a distance of 1,255 miles from the mines of Kailan Mining Administration.



Main Mill Building for the Ta Hu Cement Works

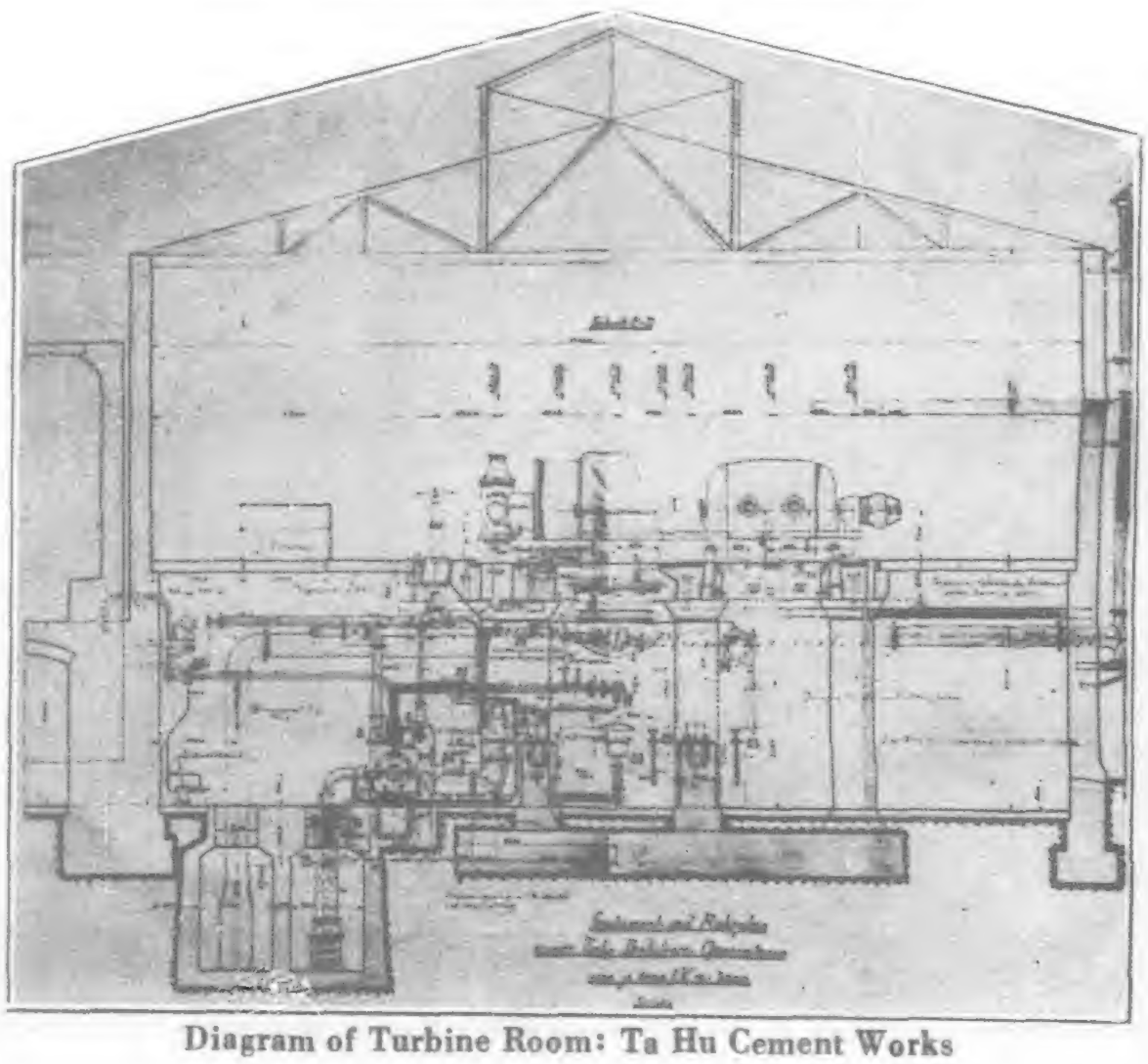
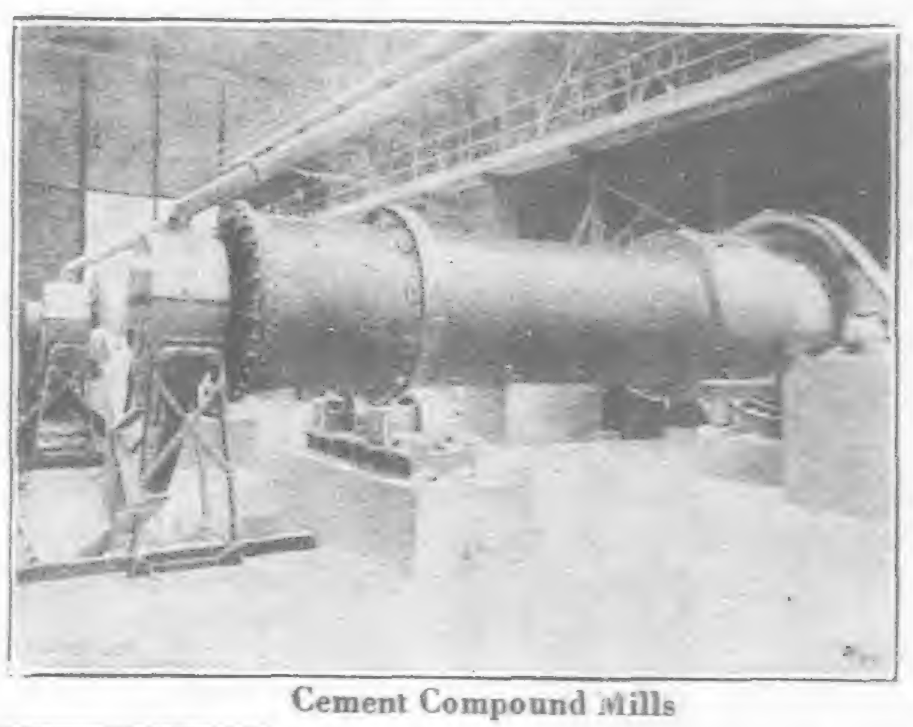


Diagram of Turbine Room: Ta Hu Cement Works



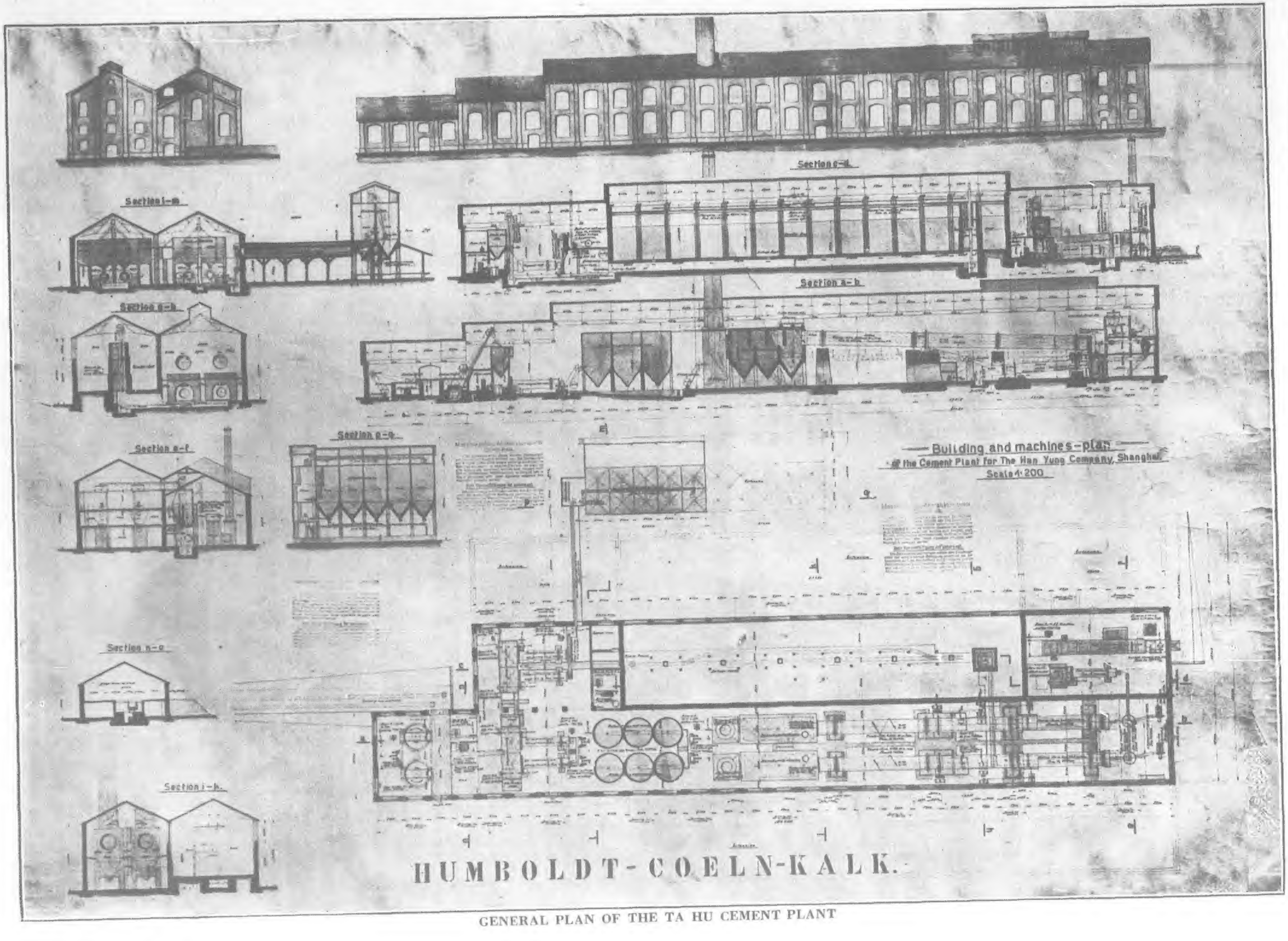
Cement Compound Mills

Shantung Cement Works

The Shantung Cement Co. is a Japanese owned and operated plant located at Tsankan, near Tsingtao, in the province of Shantung. It was established by a Japanese concern named the Santo Kagyo Kaisha at a capital of $1,000,000 yen. The equipment consists of a vertical kiln of Japanese make. The raw materials are found in the vicinity of the plant, while coal is obtained from the Tsuchuan Mine. The total output is 300 barrels per day. It may be enlarged in the future to 700 barrels.

Canton Cement Works

This plant is situated on the south bank of the river across from and directly opposite the Canton-Kowloon railway station, on the eastern edge of the city of Canton. It was built in 1907 by the imperial Chinese government but after the es-



GENERAL PLAN OF THE TA HU CEMENT PLANT

tablishment of the republic, the Kwantung provincial authorities took it over under the direction of a Chinese engineer educated at the University of Michigan.

The mill buildings are of brick. The machinery consists of eight vertical kilns with four stacks with a total capacity of 550 barrels of 375-lbs. net. Limestone is shipped from Fahyuen, 16 miles up the river and costs 93 Mex. cents per long ton. The clay is obtained from the island of Daitong, four miles down the river, and costs from $0.80 to $1.00 Mex. per long ton. Some gypsum is brought from the south and central parts of China. Some hemitate may be added to color the cement. Coal is supplied by the Kailan Mining Administration mines in North China and from Japanese mines on the island of Formosa. The Kailan lump costs $17.50 per ton and is used for burning cement in the kilns. Kailan and Formosa stock coals costing $12.000 per ton are used for heating boilers.

After preliminary crushing, the materials are mixed and ground in ball mills, using steel balls and the final grinding is accomplished in the tube mill, using beach pebbles brought from some where near Hongkong. As reported recently, the Kwangtung Cement Works are now being operated by a private concern, the Wai Kwan Co., for the Canton government at a guaranteed income of $364,500 a year. The plant is capable of turning out 500 barrels of cement daily ; but owing to shortage of raw materials and other causes, is now producing but 200 barrels a day on an average, since the first of January this year. The cement from this local factory is being sold at about $3.60 a barrel.

Green Island Cement Works

Two cement plants are operated by the Green Island Cement Co., Ltd., a British corporation registered under the Hongkong ordinances with its head office at Hongkong and managed by Shewan, Tomes & Co. One of these plants is at Kohun, a supurb of Kowloon just across the bay from Hongkong. The second is on Green Island at Macao about 40 miles by water from Hongkong. This was established in 1886.

The Green Island plant at Macao has five vertical kilns with other necessary grinding equipment of English make. The clinker is ground to 180 mesh in the tube mill, using local pebbles. The daily capacity is about 350 barrels of 375-lbs. each. Limestone is shipped from Yutak on the North River in Kwangtung (about 200 miles distance by water) and costs $3.50 Mex. per ton. Clay is dug from the mud flats about half-a-mile from the plant.

The plant at Kowloon is situated on the water front at Hoken. It has two units, one of old type, consisting of the vertical kilns and one new unit of four rotary kilns each 80-ft. long. The engines and crushers are of English make. The materials for cement are automatically weighed and mixed. The clinker is ground to 180 mesh with about 14 per cent. oversize. The limestone is shipped from Yiutak, Kwangtung, 230 miles away. Clay is brought from the affiliated plant at Macao. The daily capacity of the plant is 2,000 barrels. The report of the Green Island Cement Co., Ltd. to the shareholders from the year ending December 31, 1919 declares a gross profit of 524,717 Haikwan taels.

Ho Hong Cement Company

The Ho Hong Cement Works is located close to Singapore, Straits Settlements. The wet process is adopted for the method of manufacture. The raw materials are coral and clay. Coral is obtained from reefs located about six miles from the plant and is collected into barges by Chinese coolies with the aid of bars and axes.

The machinery is of American make. Roll crushers are used for preliminary grinding of the coral and griffin mills, for the fine grinding. Clay is obtained at the plant site, by means of dragline cableway excavation. The coral and clay are mixed in the wash mills, fed in the tube mills for final grinding and stand in concrete tanks of approximately 1,000 tons capacity. After passing the chemical test for proper composition, the slurry is fed into two 7½ by 125-ft. kilns which can produce 400-500 barrels of clinker per day. The clinker is discharged into rotary coolers placed beneath the kilns, and thence to the clinker storage house by means of a pan conveyor. The clinker is first ground in the griffin mills and finally in the tube mills. The fresh product is packed into barrels of 375-lbs. net.

Haiphong Cement Works

The Haiphong Cement Works or the Societe des Cements Portland Artificials De L'Indo-China were started on December 25, 1899. The raw materials necessary for cement manufacture are found quite abundantly in the vicinity of the plant. Consequently, the important deposits containing the best limestone are those of " Ile des Deux Songs " in the province of Quang-Yen. The clay used is drawn from the bed of the Cua-Cam River.

The process of manufacture is a dry one. It is done by mixing clay with limestone and grinding to very finely divided powder and compressing the mixture into bricks which burned in fifteen vertical kilns. The clinker is ground again to powder and the finished cement is packed in bags or barrels. The power necessary for the plant was furnished from the two turbine alternators of 1,200 h.p. each constructed by the "Societe Alsaceinne de Constructions Mecaniques " at Belfort.

The grinding machinery originally consisted of nine groups of preliminary crushers and tube mills. Later two compound crushers and three " Centaure " crushers driven by electric motor have been added. The supervision of the whole plant is in the hands of several chemists. The cement is used extensively by the board of public works in Indo-China for the construction of the railways of Tonkin, Cochin-China and Yunnan. It is not only locally consumed, but exported in considerable quantities to China, Philippine islands, Siam, Netherlands Indes, Singapore, etc. The output is 150,000 tons a year. This will be soon doubled by a new factory now in the course of construction.

Capacity of Cement Plants.

The estimated daily capacity, in barrels of 375-lbs. of the cement plants which have been so far mentioned is as follows :

	Barrels
Tongshan Cement Works	3,000
Tayeh ,, ,, ...	1,200
Shantung Cement ,, ...	300
Kwantung ,, ,, ...	500
Macao } Green Island Cement Works	350
Hongkong } Green Island Cement Works	2,000
Ho Hong Cement Co.	500
Haiphong Cement Works	2,000
Total	9,850

This give a total annual productive capacity of 3,595,250 barrels.

The brands for different kinds of cement consumed in China are as follows :

(1) Chee Hsin Cement Works ..	Horse Brand
(2) Tayeh Cement Works ..	Pagoda ,,
(3) Haiphong ,, ,, ..	Black Dragon Brand
(4) Japanese ,, ,, ..	Tiger Head Brand
(5) Green Island Cement Works ..	Black Donkey Brand
	Green Island ,,

(*To be continued in April issue*).

THE PURIFICATION OF WATER SUPPLIES WITH SPECIAL REFERENCE TO SHANGHAI

Paper Read Before the Engineering Society of China

By C. D. Pearson

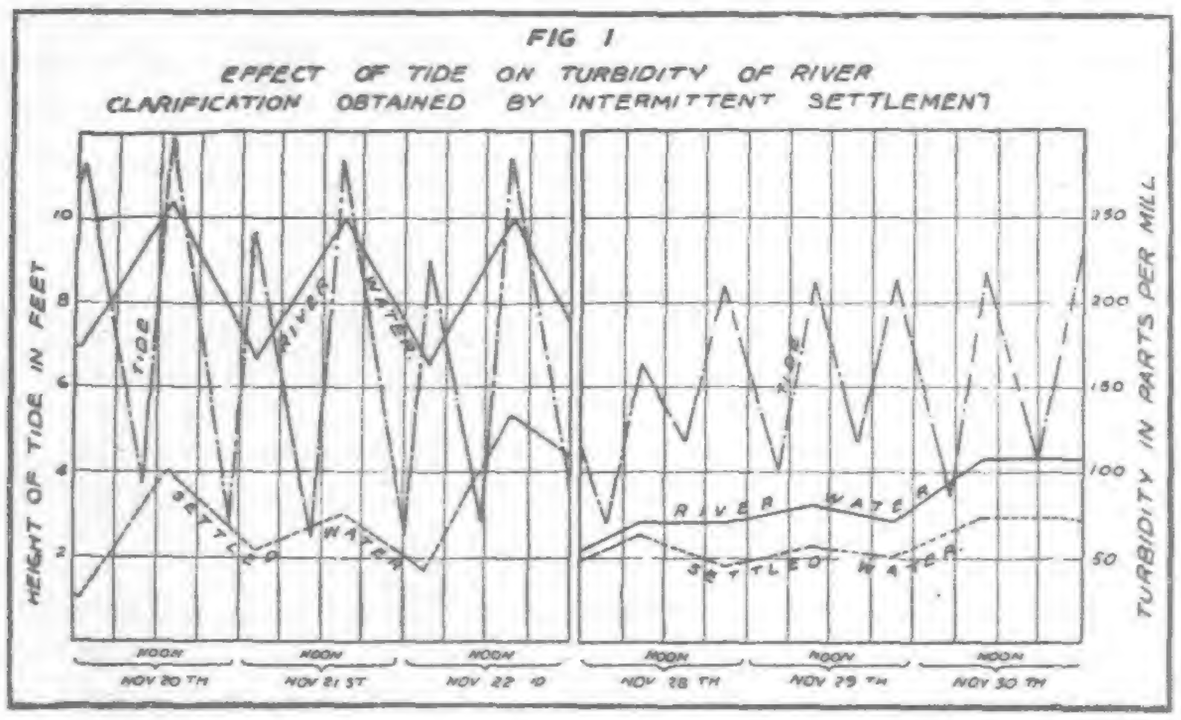
WATER purification may be broadly defined as the art of removing foreign and polluting substances from solution and suspension in water: the water engineer's share in this is to render impure water potable and hygiencally safe for drinking purposes and suitable for industrial uses.

Natural waters may be classified under two headings: Surface waters and underground waters. Although water is obtained in Shanghai and neighborhood from shallow wells and from borings, the quantity so obtained is so small, and the quality varies so greatly, that it is not proposed to touch, in this paper, upon the purification of waters obtained from such sources except to point out that, from information so far obtained, methods of purification must vary for each boring and, as regards well water, sterilising appears to be essential.

In Shanghai and vicinity, we have a flowing surface water in the Huangpu and its tributary creeks and, at a distance of about 35 miles, impounded surface waters in the form of shallow lakes.

The Huangpu affords a supply which is practically unlimited in quantity but which, as regards quality, is probably the worst water, from a water engineer's point of view, it is possible to conceive.

Huangpu water is always turbid and the matter in suspension varies, as will be seen from Fig. 1, from hour to hour largely owing



to the effect of tides; the variation is, not only in the quantity but also in the nature of the sediment. The water in the river is polluted by the wastes from the densely populated settlements and by the wash or run-off from the highly cultivated land through which the river passes. In addition to this, the water is subject to rapid and considerable changes in temperature, and this temperature change has as much effect of filtration problems as turbidity.

A less polluted but more turbid water is obtainable from the Yangtze, and a less polluted and less turbid water from the Tai Hu and Si Tai Lakes, but the distance of these sources from Shanghai rendersthem unsuitable for economical as well as political reasons.

Impurities in water can be divided into two classes: "Dissolved" and "Suspended." As regards the former, the Huangpu affords a water which is fortunately free from abnormal quantities of dissolved ingredients such as chalk, magnesia and common salt and, consequently, the removal of any dissolved mineral matter is *not necessary.*

Table 1.

Characteristics of Huangpu Water.

1917—1922.

	Solids in Suspension parts per 100,000	*Hardness in degrees (Clark)* Total	Temp.	Perm.	*Salinity (Chlorine) parts per* 100,000
Average ..	15.2	9.6	5.2	4.4	2.5
Maximum ..	*34.0	12.0	7.0	5.4	†28.0
Minimum ..	10.4	7.0	3.0	2.7	.9

Notwithstanding our propinquity to the sea, salinity has not been the cause of anxiety during the last twenty years.

Authorities have laid down the desirable maximum as 25 parts chlorine per 100,000 although many towns use a water considerably more saline than this and, as will be seen from Table 1, we have on one day only slightly exceeded the desirable limit. The small amount of hardness is beneficial as regards potability and is insufficient to render softening necessary for boilers or other industrial purposes: Shanghai water is considered excellent for brewing purposes.

Suspended impurities, the reduction or removal of which call for purification works, include the heavier sediment, consisting largely of fine sand and clay, colloidal suspensions (which are intermediate between solutions and suspensions of finely divided particles), microscopic plant and animal life (algae and diatoms) and bacteria.

The necessity of removing sediment for domestic and industrial purposes is evident and five parts per million may be taken as the limit of suspended matter for acceptable drinking water.

The removal of algae and diatoms is necessary owing to the development of bad tastes and odours often accompanying the growth and decay of these organisms.

As regards bacteria, by far the greater number play a beneficent role, but a few species are capable of producing disease. The bacillus typhosus, germs connected with dysentery, the cholera vibrio and other types emanate from the bodies of those stricken with disease and maintain their vitality in water for days, and even weeks.

The alimentary canal, in health and disease, contains an abundance of the bacillus coli, so that the presence of this bacillus in water is an indication of contamination. B. coli itself is not considered dangerous, but is an indication that more virulent species may be present. It has been proved that the purification processes which eliminate B. coli remove also the pathogenic bacteria. The latter are (*a*) less tenacious of life, (*b*) cannot pass a filter which intercepts B. coli, (*c*) less persistent in stored water and (*d*) less capable of resisting disinfectants and bactericides.

There is no definite standard of purity as regards B. Coli, but in America absence in 10 ccs. after a suitable period of culture on nutrient material is considered satisfactory; in England, absence in 100 ccs. is aimed at. It will interest members to know that with the purification methods employed water is pumped to consumers in the international settlement with B. coli absent in 100 ccs. in about 75 per cent. of the daily samples.

It is beyond the scope of this paper to discuss epidemics of water borne disease, but from Fig. 2 the effect of water filtration will be noted. It is on record that a reduction of 90 per cent. in the death rate due to typhoid fever has been obtained by introducing filtered, *in place of unfiltered, water.*

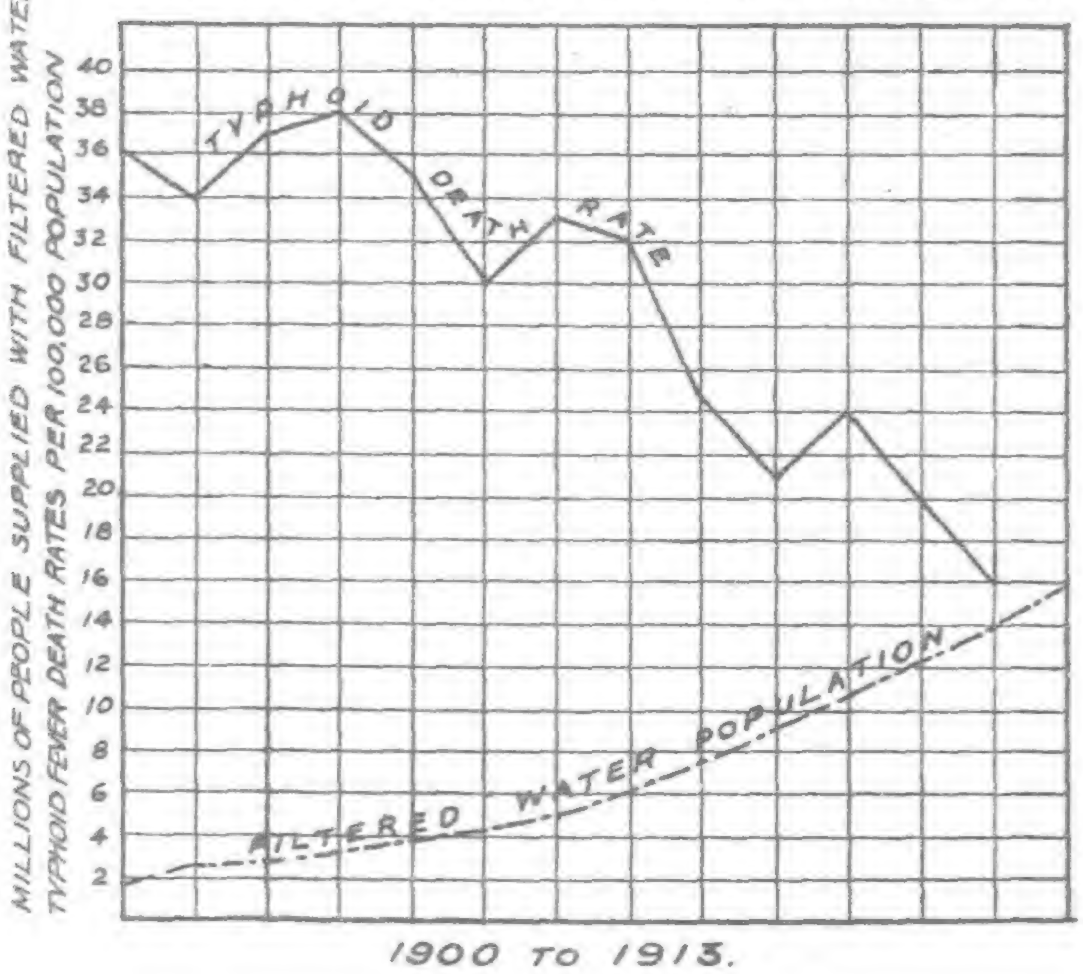
Purification Methods

Purification methods may be divided into four classes : " Storage," " Settlement," " Filtration " and " Sterilisation." These processes when artificially controlled and properly carried out are able to purify water of very poor quality.

Chemical re-agents used mechanically are employed to facilitate these processes.

FIG. 2.

EFFECT OF WATER PURIFICATION ON TYHOID FEVER DEATH RATE IN UNITED STATES



Rivers and lakes possess striking powers of self-purification. Under storage, Thames water has been found by Sir Alexander Houston to reach a safe condition in four or five weeks after being purposely infected with the bacteria of epidemic diseases, unfortunately, natural depressions do not occur near Shanghai, and the cost of constructing storage reservoirs would be prohibitive.

When Dr. Fowler visited Shanghai, he was struck with the fact that the Yangtze and its tributaries were not more contaminated than is the case considering that the whole country is manured with nightsoil, and he is of opinion "that the power of purification of these rivers is to be found in the large amount of fine silt carried by them, each particle of silt acting as a nidus for the necessary bacteria." Dr. Fowler has concluded that this natural action might be assisted artificially in a manner analogous to the activated sludge process of sewage purification, and he is now engaged on experiments with a view to ascertaining the best description of silt to be employed to produce the best results and the proper means of applying the process for the purification of water ; no definite conclusions have apparently been yet arrived at as to the merits of the scheme for the purification of water on a large scale.

Settlement, or Sedimentation

The removal of suspended material and organic matter is most easily accomplished by settlement. Plain settlement—or sedimentation without a coagulant—is the cheapest method of removing those particles which settle out in a moderately short time and which would rapidly clog a filter.

Settlement in Shanghai is necessarily effected in artificial basins constructed in masonry and of comparatively small capacity.

Settling basins may be either " Intermittent " or " Continuous:" in the first system the basin is filled, the water allowed to stand for a period sufficiently long to allow the smallest (usually called the " limiting ") particle it is desired to remove to fall below the draw-off level and the settled water is then drawn off and led or pumped to the filters.

The intermittent system has been hitherto employed in Shanghai, largely owing to the tides permitting settling basins to be filled wholly, or in part, by gravity without the necessity of deep excavations.

In continuous settlement basins the water is allowed to flow continuously through the basin or basins, baffling being employed to give the necessary settlement period and to control movement. Experiments are at present being carried out at the Waterworks to ascertain the desirable dimensions of and velocities in continuous settling basins for water of various turbidities and at different temperatures.

Although it is possible to clarify and purify even a turbid and polluted water by plain settlement and storage alone, the capacity of the basins required would necessarily be enormous and the primary duty of settling basins is, usually, therefore, to render the water suitable for filtration : the degree of clarification required being dependent upon the amount and nature of the suspended material, the type of filter employed and the temperature of the water.

TABLE 2.

COMPARISON OF DIFFERENT ARRANGEMENTS OF SETTLING BASINS.

Description of Basin.	*Values of* a-t		
	One-half removed.	*¾ths removed.*	*⅞ths removed.*
Theoretical maximum (cannot be reached)	0.50	0.75	0.875
Intermittent basins reckoned on time of service only	0.63	1.26	1.89
Intermittent basin in service half time	1.26	2.50	3.80
Continuous basin well-baffled ..	0.76	1.66	2.75
One long basin well-controlled ..	0.90	2.34	4.50

From Table 2 it will be noted that a well-baffled continuous basin (*vide* Fig. 3) is the most economical arrangement, an intermittent basin necessarily never being in service continuously.

On account of the greater viscosity of water at low temperatures, a particle of silt will settle twice as fast at a temperature of 74° F. as at 32° F.

Fig. 1 shows the clarification effected in plain intermittent settling tanks with a water temperture at 50° F. : the figure also illustrates the effect that high tides have upon turbidity.

In Shanghai natural intermittent settling tanks with an average period of twenty hours' quiescence will provide a water which can normally be dealt with by slow sand filtration.

To filter water at a more rapid rate than slow sand beds are capable of doing, it is necessary to remove the smaller particles in suspension that cannot economically be removed by natural settlement.

If these fine particles can be collected into groups which present a smaller surface per unit of volume they will settle more rapidly and their removal by sedimentation will become practicable : this collection into groups can be accomplished by coagulants.

The common coagulants are soluble salts of allumina, iron and other metals which react with the alkaline salts in the water to form an insoluble gelatinous substance which breaks up into " flocks " the size of a pin head. These flocks settle slowly but attract to themselves particles of silt, other flocks and bacteria until masses of considerable size have been formed which settle quickly.

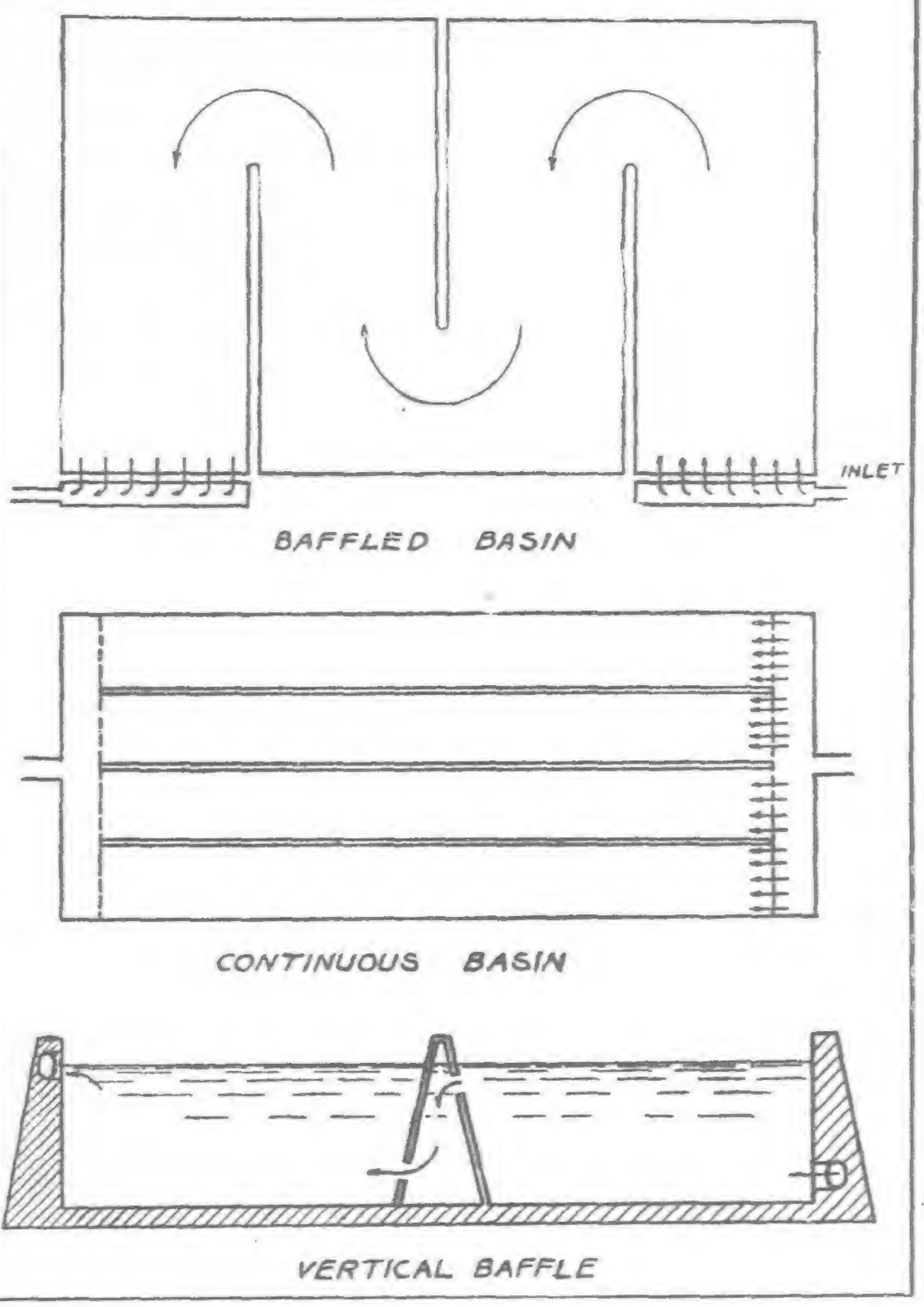
The coagulant most usually employed is sulphate of alumina which may be fed into the water in solution or in powdered form : both have been tried in Shanghai, and the latter method has been found most economical.

To ascertain the dose required various formulæ are given, but it has been found advisable to make a daily trial by adding varying

quantities of a standard solution of alum to samples of the raw water : the results so obtained with experience enable the correct dose to be ascertained.

FIG. 3.

TYPES OF SETTLING BASINS.



As will be seen from Fig. 4 considerable reduction in bacteria may be effected by natural settlement : when a coagulant is employed the reduction is greatly increased. When waters of high turbidity are clarified, removal of bacteria is probably adequate except where the water is highly polluted.

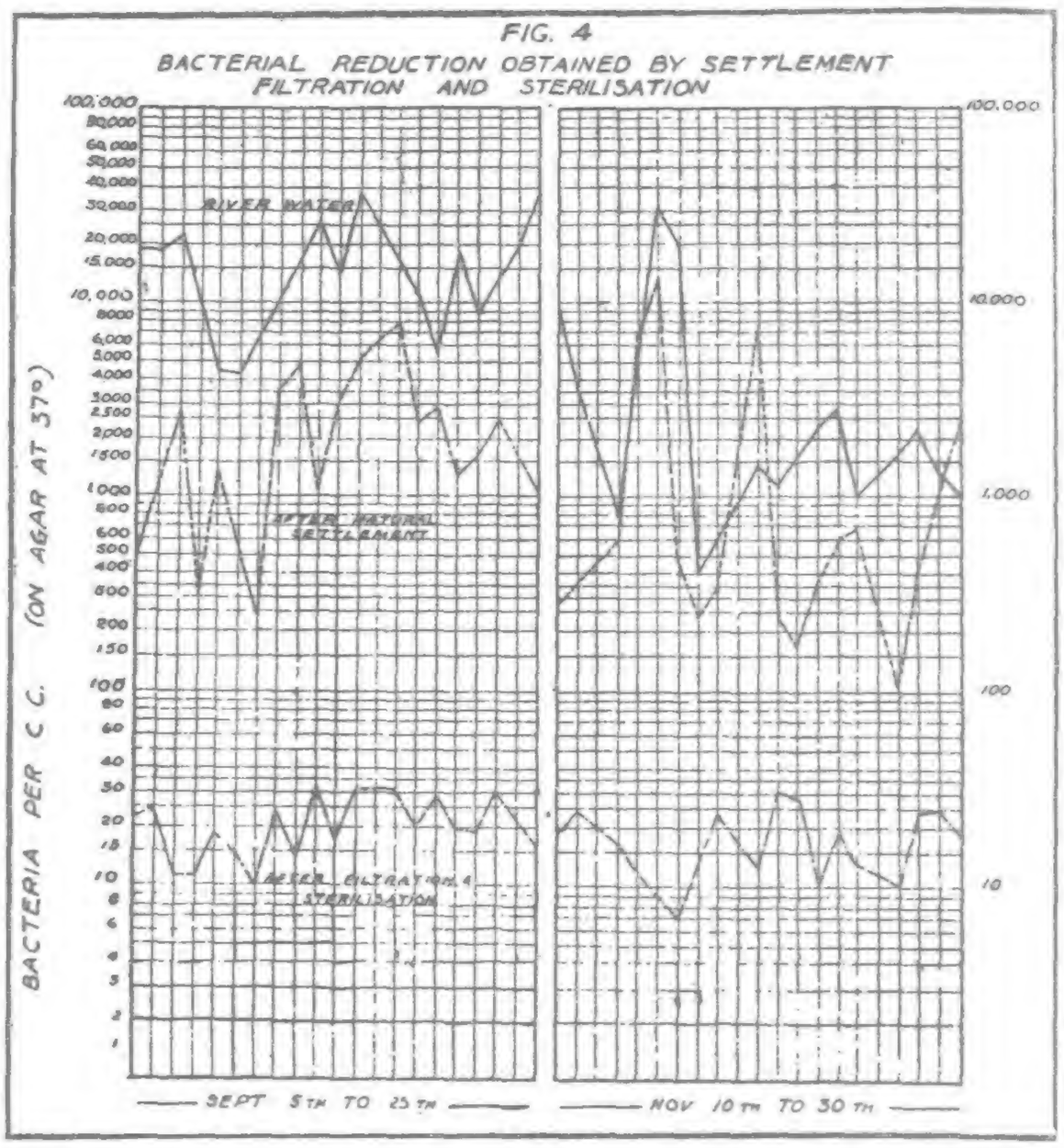
The length of time required to bring about the proper degree of clarification is influenced by the character of the suspended colloids, by the quantity of coagulant applied, by the temperature of the water and by the agitation to which the mixture has been subjected. Complete flocculation usually takes place with Huangpu water in from four to six hours.

There is a popular prejudice against putting " chemicals " in water largely due to ignorance of the fact that natural water usually contains matters as truly chemical as those used in treating water, and also that the amounts used are so minute that a consumer would need to drink hundreds of gallons to obtain a medicinal dose. The prejudice is probably not so great in Shanghai owing to the Chinese having used alum as a coagulant probably for centuries.

It will have been noticed that the expressions " Turbidity " and " Matter in Suspension " are used. Turbidity is a measurement of the opacity of a water and the standard generally adopted is that of comparison with a mixture of fine silica and water in such proportions that a platinum wire one m.m in diameter disappears from view a submergence of 100 m.m. This turbidity is called 100,

FIG. 4

BACTERIAL REDUCTION OBTAINED BY SETTLEMENT FILTRATION AND STERILISATION



and other turbidities are assigned numbers, a few of which are given in Table 3.

TABLE 3.

GRADUATION OF TURBIDITY ROD.

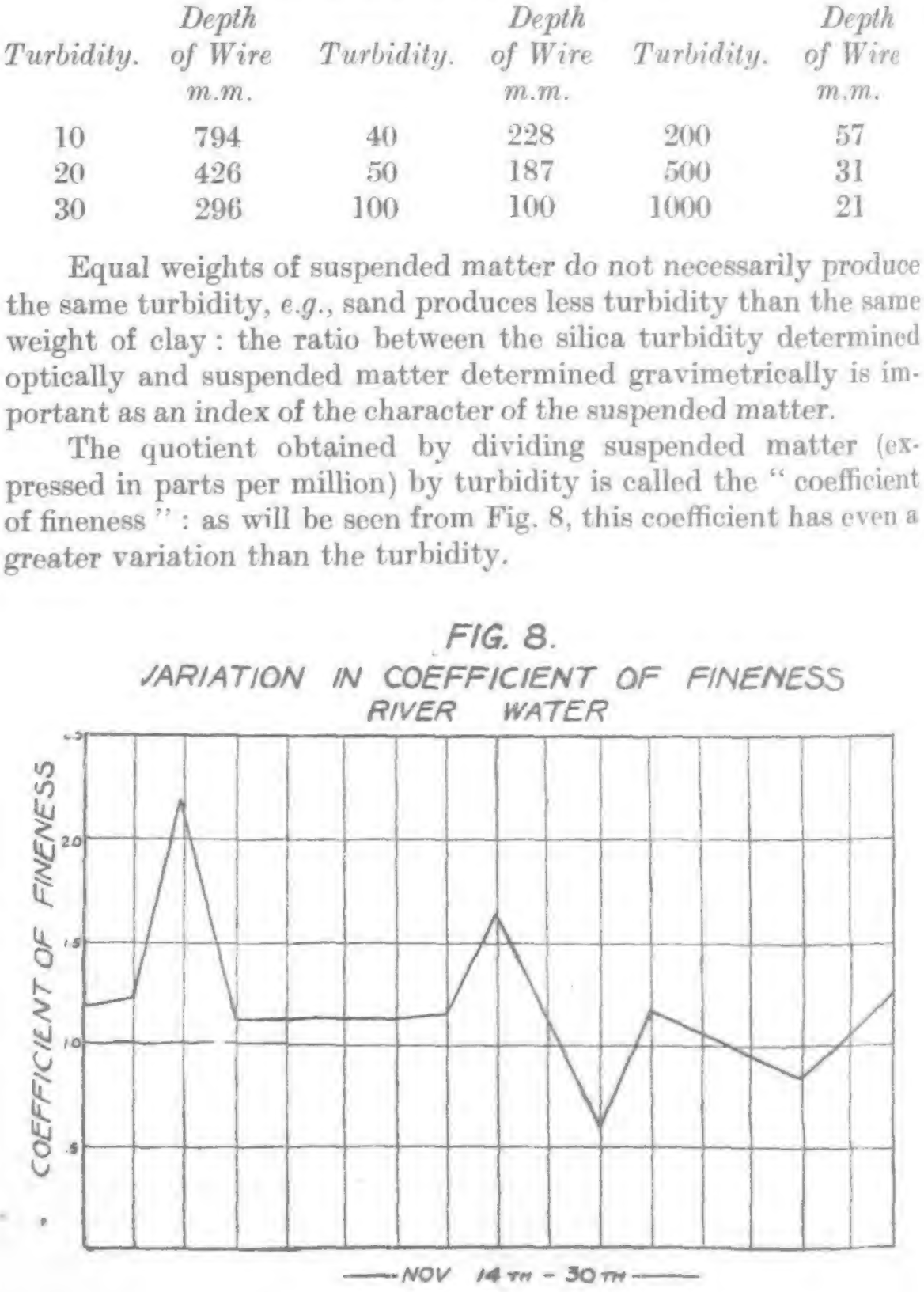
Turbidity.	*Depth of Wire m.m.*	*Turbidity.*	*Depth of Wire m.m.*	*Turbidity.*	*Depth of Wire m.m.*
10	794	40	228	200	57
20	426	50	187	500	31
30	296	100	100	1000	21

Equal weights of suspended matter do not necessarily produce the same turbidity, *e.g.*, sand produces less turbidity than the same weight of clay : the ratio between the silica turbidity determined optically and suspended matter determined gravimetrically is important as an index of the character of the suspended matter.

The quotient obtained by dividing suspended matter (expressed in parts per million) by turbidity is called the " coefficient of fineness " : as will be seen from Fig. 8, this coefficient has even a greater variation than the turbidity.

FIG. 8.

VARIATION IN COEFFICIENT OF FINENESS RIVER WATER



Filtration

Although, under certain conditions, settlement following coagulation is capable of producing satisfactory clarification it is neither economical nor safe to rely on such a method: whether plain settlement or coagulation is employed however, a water can be produced which can be satisfactorily clarified and, in most cases, satisfactorily purified by filtration.

Sand and gravel are the media almost universally employed for filtering water. The factors which affect the efficiency of filters are:

the thickness of the bed
the size and uniformity of the sand grains
the nature and temperature of the water
the amount and nature of the coagulant used
the rate of flow.

The primary function of a filter is to strain out suspended particles: those particles larger in size than the interstices between the sand grains are, of course, readily strained out, but it is also found that, after a filter has been in service for some time, the submicroscopic particles and bacteria are also removed.

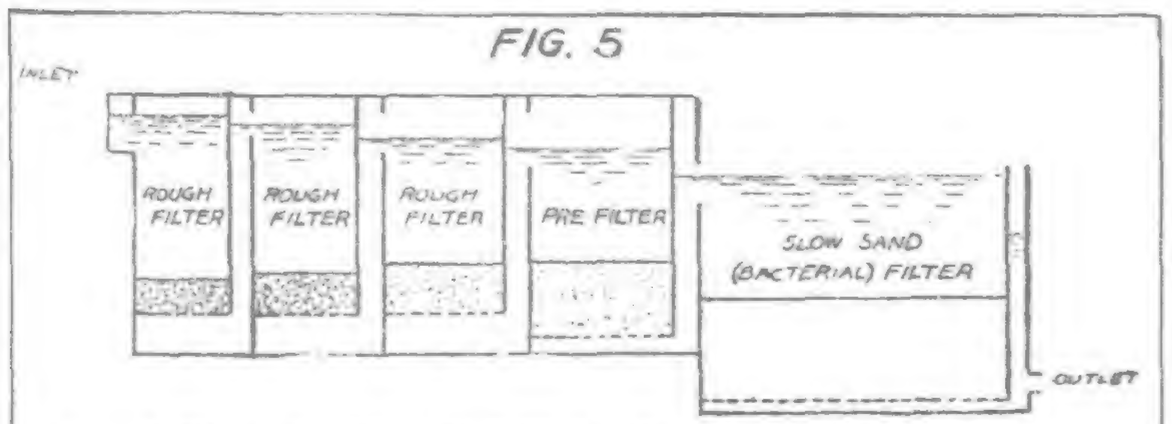
A close examination of a well ripened filter reveals the sand grains covered with a gelatinous film which is most abundant near the surface but permeates to some depth. The material forming this film is composed of organic matter in gelatinous form partly or wholly filling the interstices between the sand grains.

Water passes readily through this gelatinous material but the very fine suspended particles are kept back either because they are too large to pass through the openings or because they stick to the surfaces of the gelatinous matter already in the bed.

Before a turbid water is passed through a filter, it is necessary to partially clarify it by settlement with or without a coagulant or by pre-filtration through roughing filters. Roughing filters have been used in addition to settlement in Shanghai for a considerable period but have now been abandoned.

A combination of roughing and slow sand filters shown in Fig. 5 has been employed to a considerable extent on the Continent. In this system, the water is passed through a series of pre-filters each one of greater area than the previous one and containing a finer gravel. This system has been used in Shanghai and also in connection with turbid waters in India and Egypt.

FIG. 5



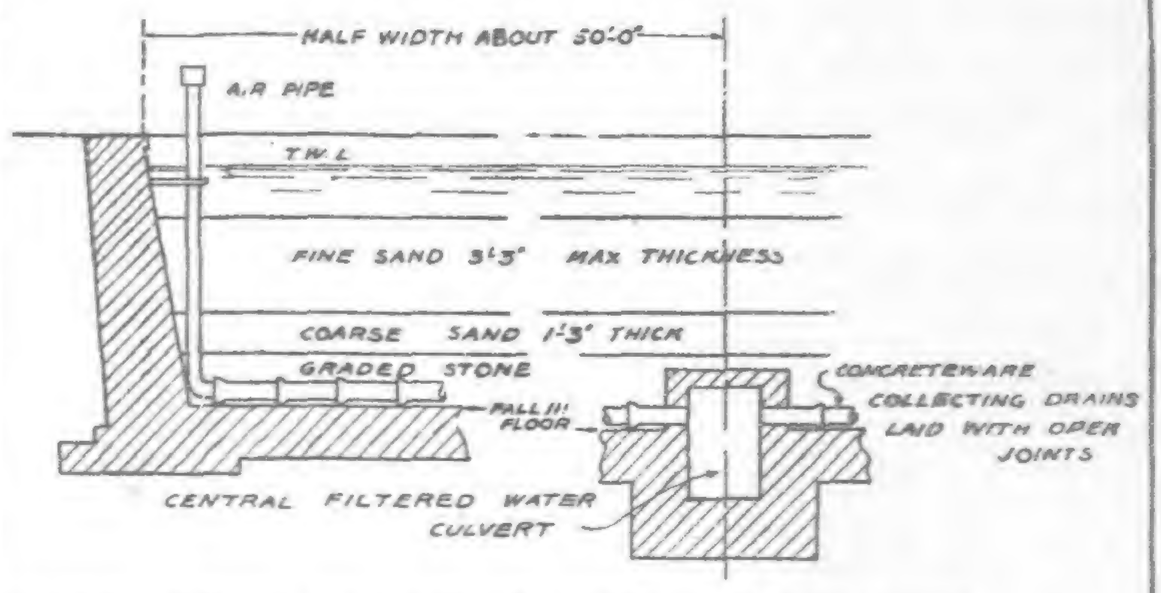
PUECH CHABAL SYSTEM OF FILTRATION

The original type of filter was the slow sand or English filter.

These filters are usually rectangular in plan and contain a filtering medium consisting of a thick layer of fine sand supported on layers of gravel and stone. Filtration is downward, the filtered water being collected by under-drains laid on the bottom of the filter basin, these drains discharging into a central culvert which discharges into the clear water well.

Fig. 6 shows the arrangement of the filtering material and drains in the beds used at the Shanghai Waterworks, these beds have successfully clarified and purified the greater portion of the water supplied to the international settlement for the last forty years. A satisfactory filtrate is usually obtained from these beds with rates of filtration varying from 2.0 to 1.5 gallons per square foot per hour. The sand employed is ordinary Ningpo sand, an analysis of which is given in Table 4.

FIG. 6



PART CROSS SECTION OF SLOW SAND BED

TABLE 4.

MECHANICAL ANALYSIS OF SAND FOR SLOW SAND BED.

	Percentages passing through sieve.		
Meshes per lineal inch.	*Sample I. Fine sand taken from bed.*	*Sample II. Same sand as in Sample I but with portion retained on 10 and passing 40 sieves rejected.*	*Sample III.*
10	82.55	100.0	100.0
20	57.65	59.7	81.6
30	29.45	17.55	6.4
40	15.65	0	0
Effective size	0.43	0.61	0.69
60% finer than	1.2	1.02	0.82
Uniformity coeff	2.78	0.67	1.33

To clean a slow sand bed the usual practice is to lower the level of the water below the surface of the sand and remove the top layer—usually about 1½-in.—after this "scraping" the bed is charged with filtered water and the filtrate is then run to waste as found necessary until a new film is formed.

As will be realized, the expense of maintaining a slow sand bed is mainly in cleaning and washing the sand removed. The period between "scrapings" varies according to the amount and nature of the suspended matter in the water, but it is usually found necessary to scrape every 14 days. When the layer of fine sand is reduced to a thickness of about 1-ft. 6-in., clean fine sand is added to the full thickness of 3-ft. 3-in.

With cheap land and labor, slow sand beds are still economical, and this method of filtration has many advantages, however, the cost of land and labor and increased pollution have now rendered it advisable to adopt, in Shanghai, rapid filtration.

An intermediate stage between slow and rapid filtration has been employed in Shanghai for the last two years with satisfactory results: water after being clarified by means of a coagulant in intermittent settling tanks is passed through slow sand filters at about three times the normal rate and the resultant filtrate has been most satisfactory both as regards clarification and purification.

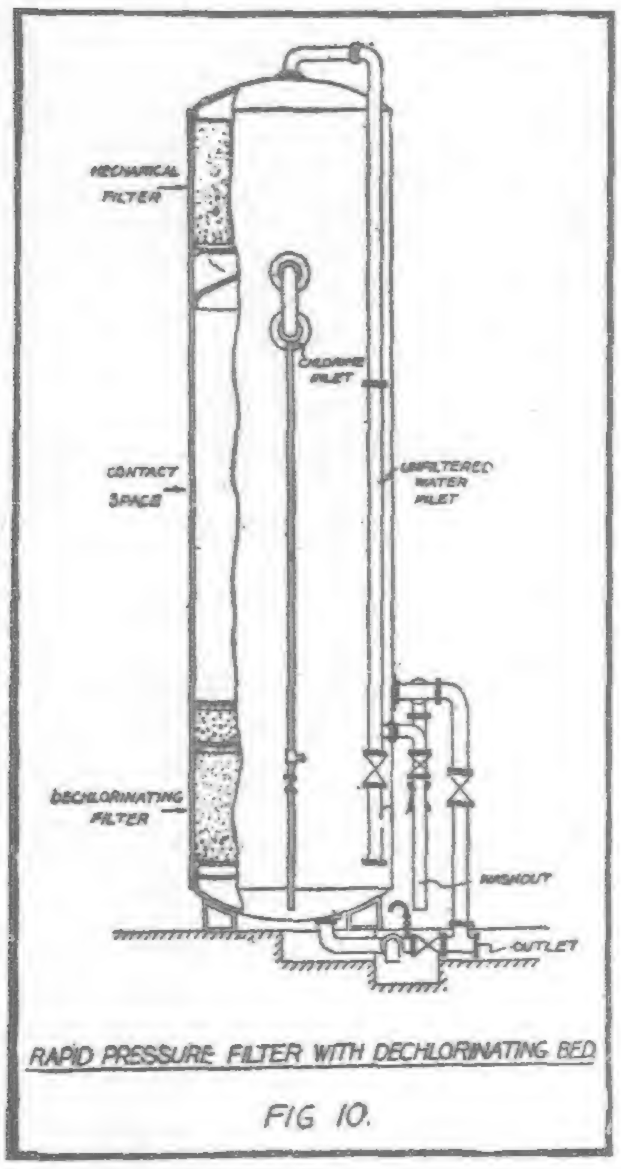
With a clear water exposed to bright sunlight, it is reasonable to expect heavy algal growths, but so far no trouble has be caused by algae either in clogging the beds or in imparting taste or color to the water.

The rate of flow in rapid filters is usually about 120 gallons per square foot per hour, *i.e.*, 50 times as fast as slow sand beds, and in consequence, relatively small areas are required with consequent reduction in initial cost but, as coagulation prior to rapid filtration is essential, working costs are necessarily higher.

The usual filtering medium in rapid filters is sand supported on a gravel layer; the filtered water being collected through a system of strainers. The water having been treated with a coagulant carries a certain amount of flock, this is caught in the top

layer of sand and the remaining water passes through the fine pores leaving behind the finest suspended matter not previously enmeshed by the coagulant.

Should the raw water not contain sufficient flock, it is necessary to film the bed by adding a coagulant, usually an aluminium sulphate solution, to the water on top of the filter.



RAPID PRESSURE FILTER WITH DECHLORINATING BED

FIG 10.

As rapid filters deal with 50 times as much water as slow sand beds, per unit of area, they require more frequent cleaning, this is effected in most cases by reversing the flow of water through the filter: the upward flow carries off most of the silt and coagulant jelly and the dirty water is drawn off through overflow channels.

In several of the smaller types of rapid filters revolving arms, or rakes, are employed to loosen the sand, in others hydraulic jets are used and in large types compressed air: in the latter case, the air is applied for several minutes prior to the admission of the wash water.

The larger rapid filters are usually cleaned by the application of wash water under pressure at a rate of about 12 gallons per square foot per minute, the proportion of wash water to effluent being normally two per cent.

Rapid filters may be divided into two classes, pressure filters and gravity filters. The former are closed cylinders fixed vertically or horizontally containing sand through which the water is forced under pressure. Figs. 10 and 11 show two pressure filters, the former is of interest as it is a continuous filter which is cleaning itself as it works. Pressure filters are best adapted for delaing with comparatively small quantities of water, and where large outputs are required the gravity type is usually preferred.

Gravity filters are usually arranged in units of about 400 sq. ft. area dealing, at prevailing rates for this type, with about one million gallons per day. The filters may be constructed of steel, concrete or timber, circular or rectangular in plan: the usual arrangement is as shown in Fig. 9 in which a double battery of filters are divided by a pipe gallery.

Present practice in rapid filtration usually provides for a depth of sand ranging from 20-in. to 36-in. although lesser depths may be used successfully if the sand is sufficiently fine.

The size of sand grains at present being used locally is given in Table 5, but it appears desirable to use a fine sand with slightly smaller grains.

TABLE 5.

DETAILS OF FILTERING MATERIAL IN RAPID FILTERS.

Thickness of layer in inches.	*Material.*	*Size of mesh passing material.*	*Size of mesh retaining material.*
21	fine sand	16 per lin. inch	30 per lin. inch
3	coarse sand	10 ,, ,,	16 ,, ,,
2	gravel	3/16″ sq.	10 ,, ,,
3	,,	3/8″ sq.	3/16″ sq.
4	,,	5/8″ sq.	3/8″ sq.
4	,,	1″ sq.	5/8″ sq.
5	,,	2½″ sq.	1″ sq.

A comparison between Tables 3 and 4 shows that ordinary Ningpo sand, while well adapted for slow sand filters, requires 60 per cent. sifting out before it can be used in a rapid filter.

The depth of the gravel layers is dependent upon the method of washing employed, but those given in Table 4 have been found satisfactory locally with a pressure water wash.

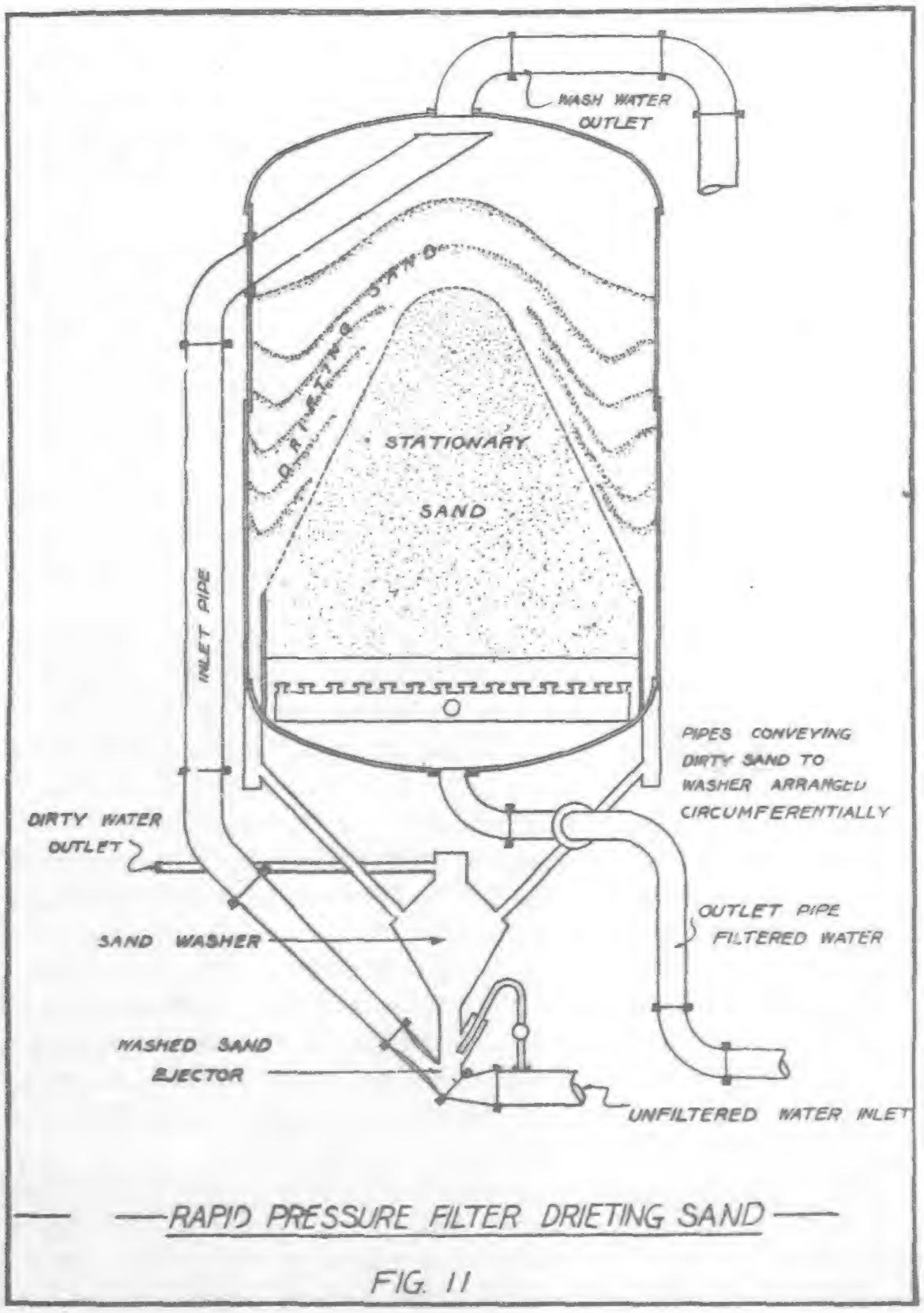
The strainer system of a rapid filter serves the double purpose, in most types, of collecting the filtered water and of distributing the water required for the cleansing of the filter during washing.

Fig. 7 shows a few of the many types of filter bottoms.

The rate of flow through rapid sand filters is usually automatically controlled: there are numerous devices in use, one of the most successful depending upon the difference in pressue of the full and contracted portions of a Venturi tube being used to operate, directly or indirectly, a valve controlling the outflow from the filter.

To ascertain when a filter should be cleaned, it is necessary to have a loss of head gauge which records the difference in level of the water above the sand and that to which it will rise in an open pipe connected to the effluent pipe: these gauges are operated by floats placed in tubes connected to the parts of the filter mentioned.

Experimental work in Shanghai has proved the efficacy of rapid gravity filters in affording good clarification and, under most conditions, good bacteriological reductions.



RAPID PRESSURE FILTER DRIETING SAND

FIG. 11

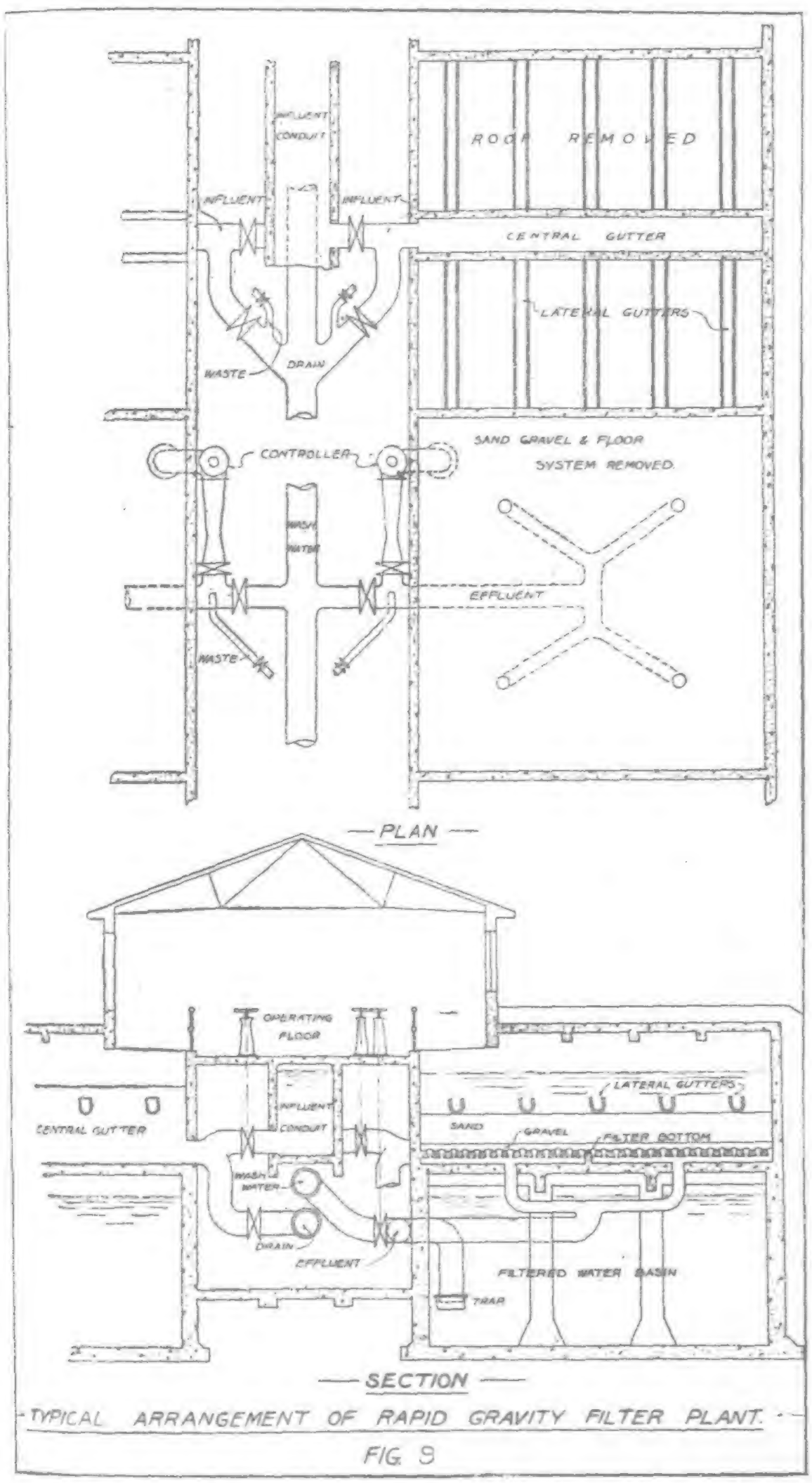
Sterilisation

The removal from a water of disease producing organisms, as well as those which are harmless, is accomplished, mechanically, by the processes already described.

The pathogenic organisms which, by chance, pass through a filter may, or may not, be injurious from a sanitary point of view

since their ability to infect depends in a great measure upon their number and virulency.

As an additional safeguard to the purification methods previously described, sterilisation has been employed for the last 25 years, but the greatest strides in its use have been made during and on account of the late war when polluted supplies were, so often, all that could be obtained.



TYPICAL ARRANGEMENT OF RAPID GRAVITY FILTER PLANT.

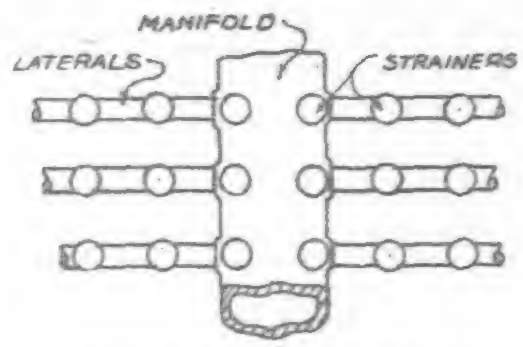
FIG. 9

Disinfection, or even sterilisation, may be obtained by boiling, but on account of the cost it is an impracticable method where any considerable quantity of water has to be treated.

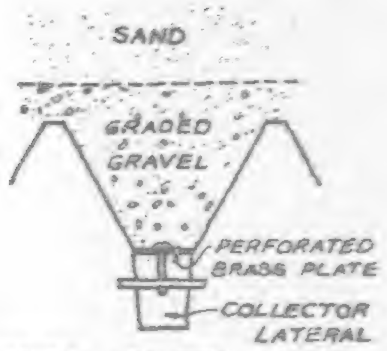
Sterilisation may also be effected by ozone. The usual method is to blow ozonised air into the bottom of scrubbers—usually towers 12 to 15-ft. high—containing coarse gravel, the water to be sterilised passing downward through the scrubber. The largest plant constructed is capable of dealing with 13 million gallons per day but it has, apparently not been a success, owing to the difficulty in obtaining a sufficiently intimate mixture between the air and water.

The destructive effect of sunlight upon many of the lower forms of plant life is well known and it has been proved that bacterial growth can be prevented by exposure to the violet rays of the spectrum, but that the invisible rays beyond the violet rays having

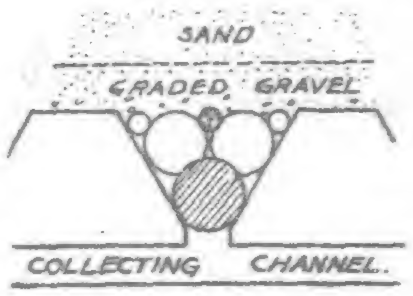
FIG. 7.



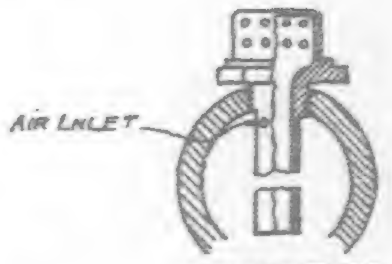
TYPICAL ARRANGEMENT



PERF. PLATE TYPE



WHEELER BOTTOM



CONTINENTAL TYPE

RAPID FILTER STRAINER SYSTEMS.

the shortest wave lengths are the most effective bactericidal agents : many of the pathogenic forms can be destroyed by an exposure of 10 to 40 seconds.

The difficulty in ensuring that all bacteria in the water are exposed to the light rays has prevented sterilisation by ultra violet rays becoming a practicable means of sterilising any but small quantities of water.

The agent commonly employed for disinfecting water supplies is chlorine, either in its gaseous form or as calcium hypochlorite or bleaching powder.

The latter contains from 30 to 37 per cent. available chlorine and a diluted solution is fed into the water to be disinfected. The liability to deteriorate and its corrosive properties have been the chief objection to bleaching powder, and it is being rapidly displaced by liquid chlorine.

There are several devices for applying chlorine gas obtained from liquid chlorine : the difficulties arising from the pressure variations of the gas at different temperatures, its corrosive effect on metals in the presence of moisture and its slight solubility have been successfully overcome.

Bleaching powder has been displaced by liquid chlorine in Shanghai, and the apparatus used to feed it into the water to be disinfected has been most successful.

The dose found desirable has been very small varying from 0.1 to 0.3 parts per million. With such small doses dechlorination is not necessary, but this can be accomplished by passing the water through a charcoal filter or treating it with sodium thiosulphate.

A mechanical filter with dechlorinating bed now in use at Chinkiang is shown in Fig. 10, and is apparently yielding an excellent filtrate both as regards clarification and purification, the raw water being pumped direct from the Yangtze without previous settlement.

The reduction in bacteria obtained at the Yangtszepoo works by means of settlement, filtration and sterlisation is shown in Fig. 4, the mean reduction during the period given—which is a fair average—being 99.8 per cent.

Mr. Allen Hazen, the consulting engineer of New York, has formulated what he calls the "six lines of defence" against waterborne disease. They are : (1) Ownership of catchment area ; (2) sanitary supervision of watershed ; (3) treatment of sewage arising on the watershed ; (4) storage of water ; (5) filtration, including sedimentation and coagulation ; (6) disinfection.

The first three lines are necessarily difficult to occupy with a watershed of 600,000 square miles, the fourth is, unfortunately, impracticable for Shanghai at present, but it is hoped that this paper will show that the last two lines are being satisfactorily held.

Some Recent Electrical Developments in Japan

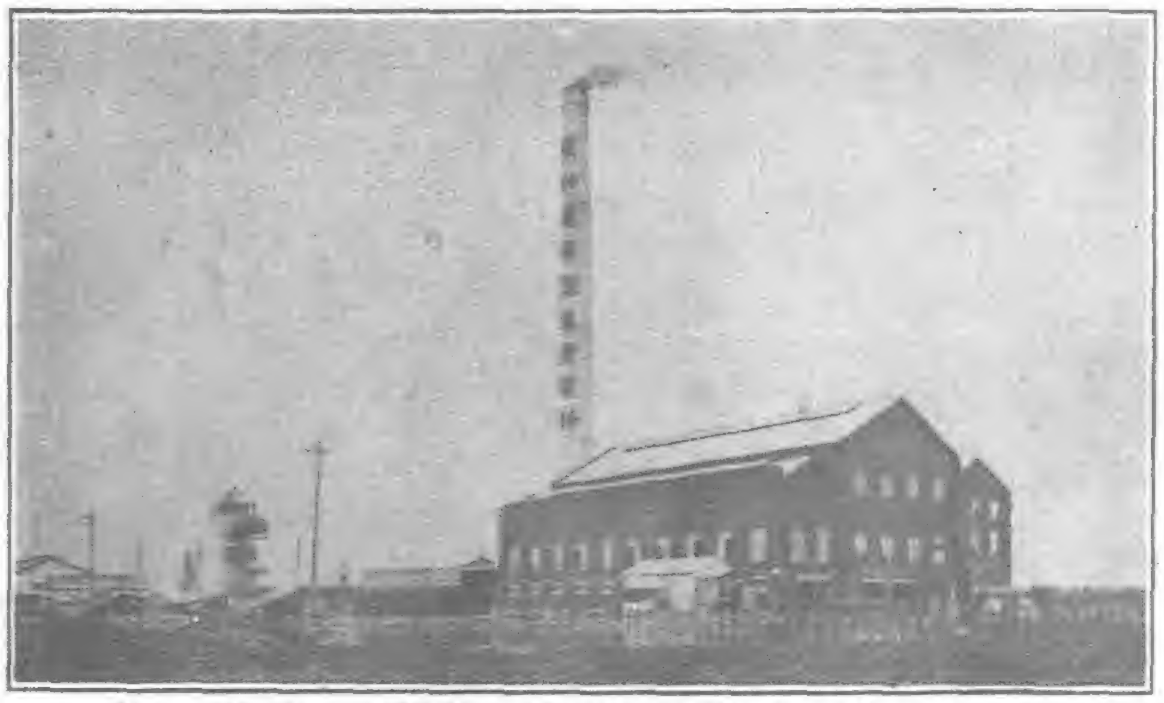
Water Power Resources of Central Japan.

WATER power enterprises in Central Japan, in the prefectures of Aichi, Mie, Gifu, Toyama, Ishikawa and Fukui, have been gradually increasing in numbers in recent years. On the rivers flowing into the Japan Sea, and those to the south, something like 780,000 h.p., is generated by power plants having a capacity of more than 100 h.p. The Kiso River yields the greatest amount of power; the Jintsu, Kurobe and Sho Rivers, yield more than 100,000 h.p. each. On the River Kiso there are seven power sites where more than 10,000 h.p. is now generated. The Jintsu and Kurobe Rivers have six sites of similar power; the Sho River has four, and the Joganji and Kuzuryu rivers have two sites each. The a ount of water power now generated at these sites is about one-quarter of the total generated from water power in Japan to-day.

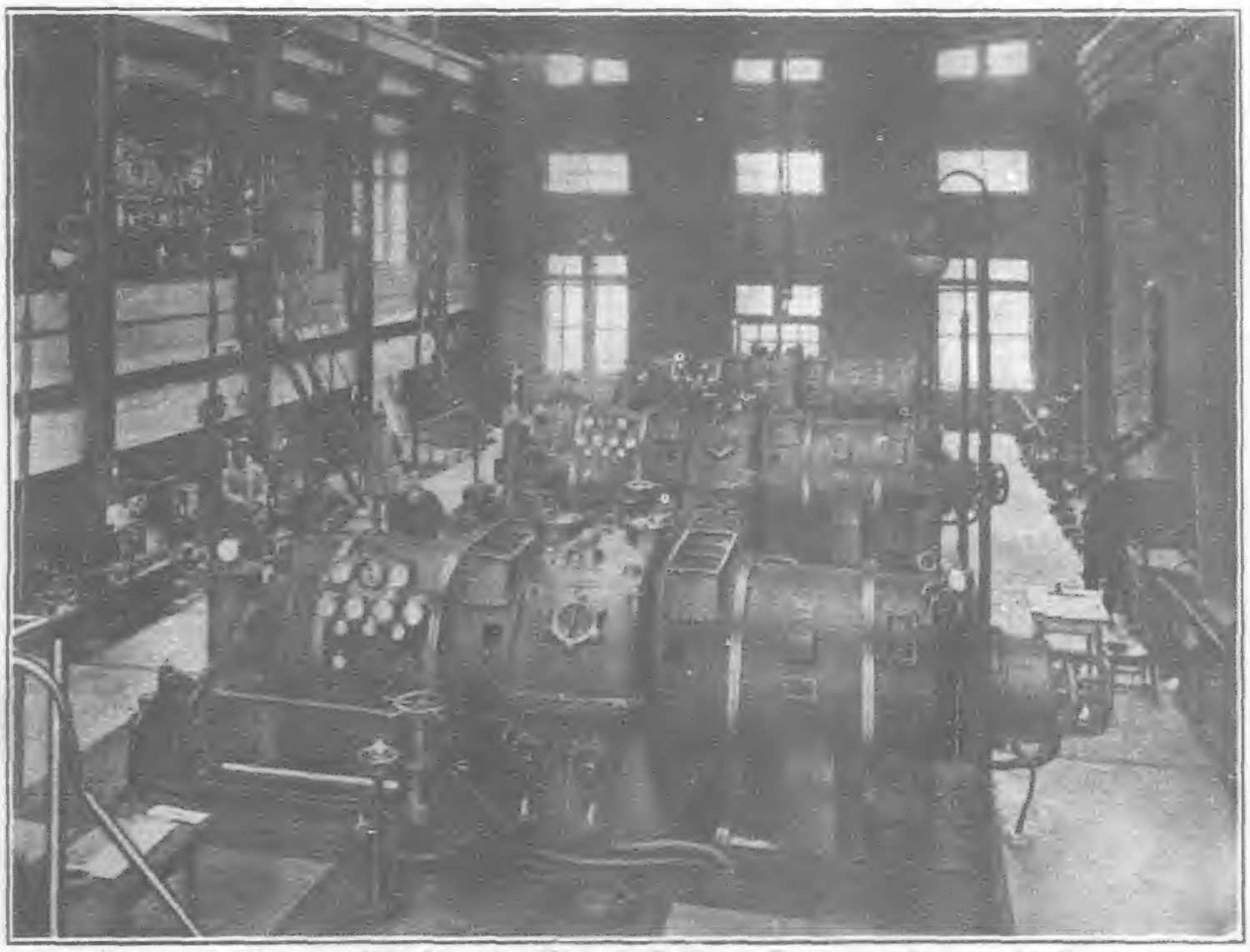
The average power generation capacity per square *ri* (*ri*= 2½ miles) in Central Japan is 620 h.p.; for all Japan it is only 220 h.p. The number of power plants licensed to be built in Central Japan is now 225, to generate a total of 1,340,000 h.p. Only 260,000 on this total capacity is in operation. There are many companies which have not yet started construction, and many which will never start construction. This is due to the fact that unconsidered competition for favored power sites has crowded the investment field, and funds are not obtainable to develop even some very favorable regions.

The supply of water in Central Japan is ample. Classifying power sites according to their generation capacity, 22 per cent. will yield from 1,000 to 10,000 h.p., while 74 per cent. will generate more than 10,000 h.p. each. The recent official survey of water power in Japan has shown 230 sites, capable of generating 1,012,172 h.p. in Central Japan. Each of these sites produces more than 1,000 h.p. About 78 of these sites are already licensed to produce 565,829 h.p. The following table shows the location of the sites which have not yet been licensed to any concern:—

River.	No. of Sites.	Capacity.
Toyo	4	4,166 H.P.
Yasaku	5	7,782
Kiso	40	90,429
Kushida	5	3,599
Kumode	5	4,231
Miya	8	7,920
Sakai	1	651
Ko	1	961
Kurobe	3	73,573
Joganji	1	3,101
Katagai	1	3,148
Jintsu	25	73,125
Sho	18	95,580
Asano	1	879
Sai	3	3,684
Tedori	8	25,358
Tei	1	563
Daishoji	1	325
Kuzuryu	11	43,264
	152	446,343 H.P.



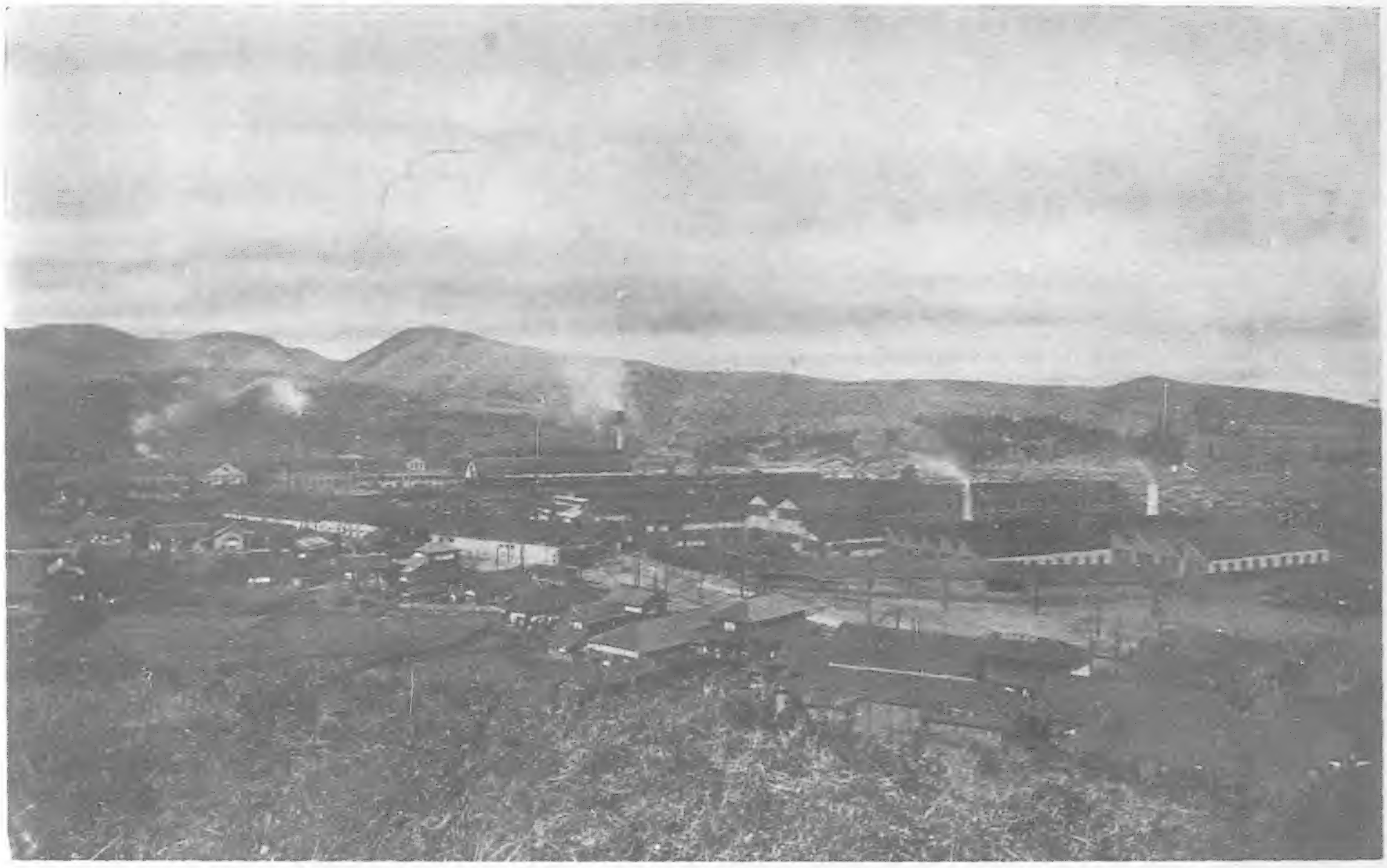
Power Station of the Hanshin Electric Railway Company at Amagasaki, Japan



Generating Room of the Hanshin Electric Railway Company, Amagasaki, Japan: Equipped with three 4,200 k.w. Stal. Turbo-Generators

Competition for the supply of materials to equip these new plants is naturally keen, and although foreign manufacturers are obtaining many of the larger orders, a fair proportion is being placed with the larger Japanese electrical machinery manufacturers notably the Shinaura, Mitsubishi, Hidachi and others. In another article is given an idea of the progress made by the Mitsubishi interests in the manufacture of high-grade turbo-alternating machines, and in a recent article we described the plant and operations of the Shibaura Engineering Works. The Hidachi Engineering Works operated by the Kuhara interests which suffered somewhat from the slump of two years ago, however, is making strenuous efforts to hold its own and has obtained many important orders for new equipment.

In the matter of water turbines, the Swiss firm of Escher, Wyss & Company has had remarkable success in Japan and seem to set the standard in competition. The Hadachi Engineering Works claim to have made and installed water turbines whose actual operating results show as great an efficiency as any of the foreign manufactured products. Some



General View of Hidachi Engineering Works, at Sukegawa, Ibaraki Prefecture, Japan
One of the Largest Manufacturers of Water Turbines and Generators in Japan

of these Hidachi turbines were illustrated in our April, 1922, number.

Hidachi Equips Many New Plants

Since then, the Hidachi Works have supplied to the Hirose Denryoku Company for its Moniwa plant a vertical shaft turbines and generators and two 4,444 k.v.a. turbines and generators for the Takenosawa plant of the Kinugawa Hydro-Electric Company. These generators are equipped with Kingsbury bearing pneumatic brakes and have a maximum of 7,400 kilowatts capacity with a head of 275-ft. and single spiral of 500 r.p.m. This plant is located at Fujiwara-mura, in Tochigi prefecture. One of the turbines was tested on January 7 of this year and the other is now ready for its official tests. These turbines have vertical shafts of 65-ft., a rare size in Japan. The switchboard and other accessories have also been supplied by the Hidachi Works.

At their power plant located at Komamaki-mura, Gunma prefecture, the Tokyo Electric Company has also installed four Hidachi water turbines of 6,750 h.p. each operating under a head of 374 feet, single spiral with pneumatic brakes. The generators, however, are from the Westinghouse Company and have a capacity of 4,800 k.v.a., 50 cycle, 6,600 volts with Kingsbury bearings. These turbines have all passed successfully the heavy tests and been accepted. Another 1,500 h.p. and 1,370 h.v.a. generator turbine has installed in its Torinami plant of the Shidzuoka Electric Company, located at Shibatomi-mura in Shidzuoka prefecture. The results have been satisfactory that plans have been made to increase the equipment of this and the Okazaki plant, by the addition of one more turbine in each.

The Nankai Hydro-Electric Company has also installed a 435 h.p. generator driven by a Hidachi 510 h.p. water turbine, head 26 feet at its Matsubara plant at Ishigaki-mura in Wakayama prefecture, and another 710 h.p. Hidachi turbine is being installed at the main mill of the Uchiumi Spinning Company at Uchimi-machi in Wakayama prefecture. The capcity of this generator is 450 k.v.a., 1,199 volts. The head is 750 feet. In addition to the larger turbines installed at the Takenosawa plant of the Hirose Electric Company, the Hidachi Works has installed in the Moniwa plant of the same company a 650 k.v.a., generator operated by a Hidachi 850 h.p. water turbine. The head is 57 feet, single open spiral wheel.

The Daido Denryoku K. K.

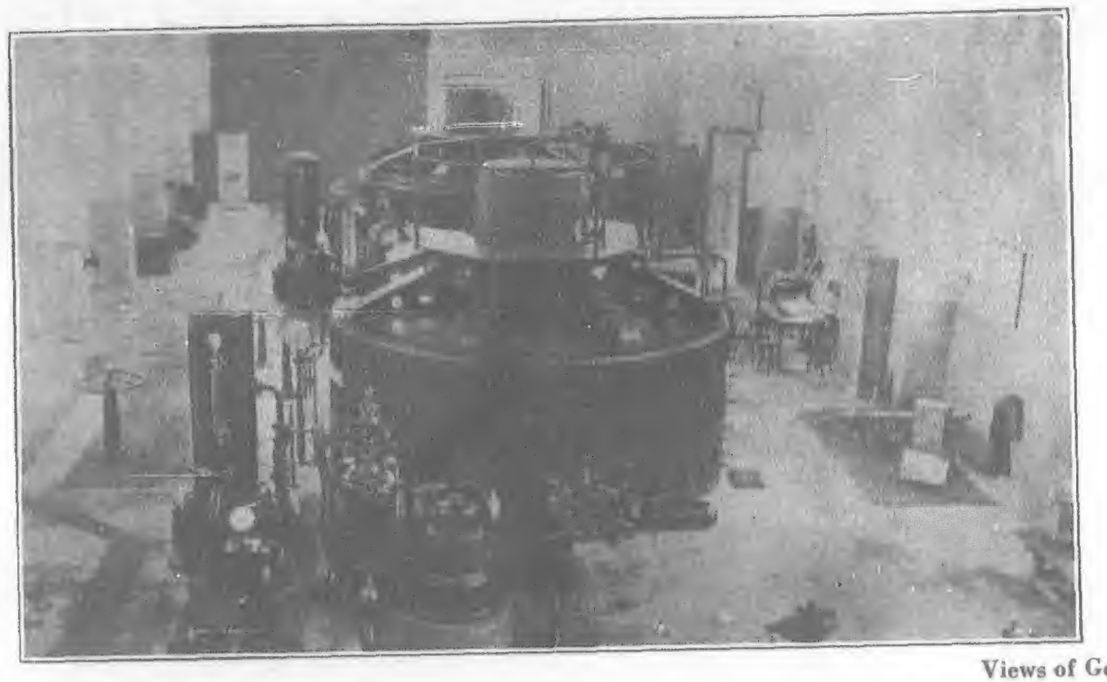
The Daido Electric Power Co., Ltd., paid a dividend of 6.2 per cent. on its total paid-up capital of Y.44,000,000. The authorized capital is Y.100,000,000, with outstanding debentures amounting to Y.20,000,000. The power plants in operation and to be erected by this company are licensed for a maximum of 200,000 kilowatts, of which 120,000 kilowatts are now under construction. At the end of the first business term 1922, the amount of power actually generated was 38,000 kilowatts. It is reported that costs of all construction to date have reached Y.16,470,000, an averages of Y.427 for each kilowatt generated. The head office of the company is in Nagoya. M. Fukuzawa is president, K. Miyazaki, vice-president, and S. Mitsume, engineer in chief. This company has received permission to supply power to Osaka and Sakai and their outlying districts.

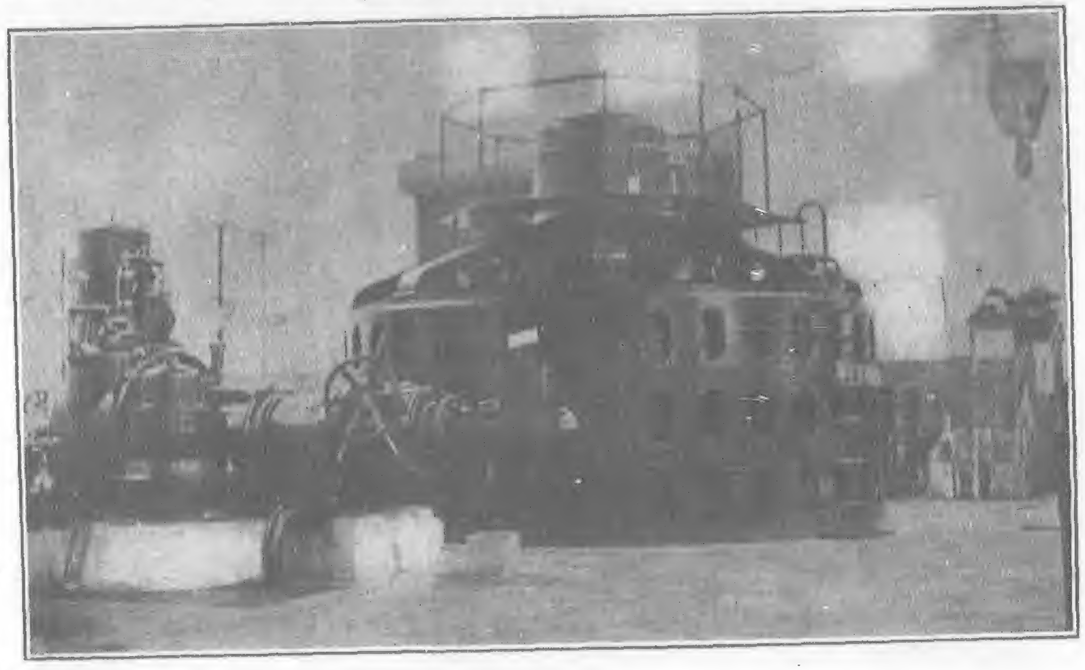
New Electric Supply Company

Promoted by M. T. Honda, and Mr. C. Takatsu, with a capital of Y.1,000,000, of which one-fourth had been paid up, the Watarase Suiden K. K. (Watarase Hydro-Electric Co., Ltd.,) was organized on September 27, 1922, to engage in the sale of electric machinery, and build power plants for the account of other concerns. This is a Tokyo company but its office has not yet been announced. It can be addressed in care of the electric bureau, department of communications, Tokyo.

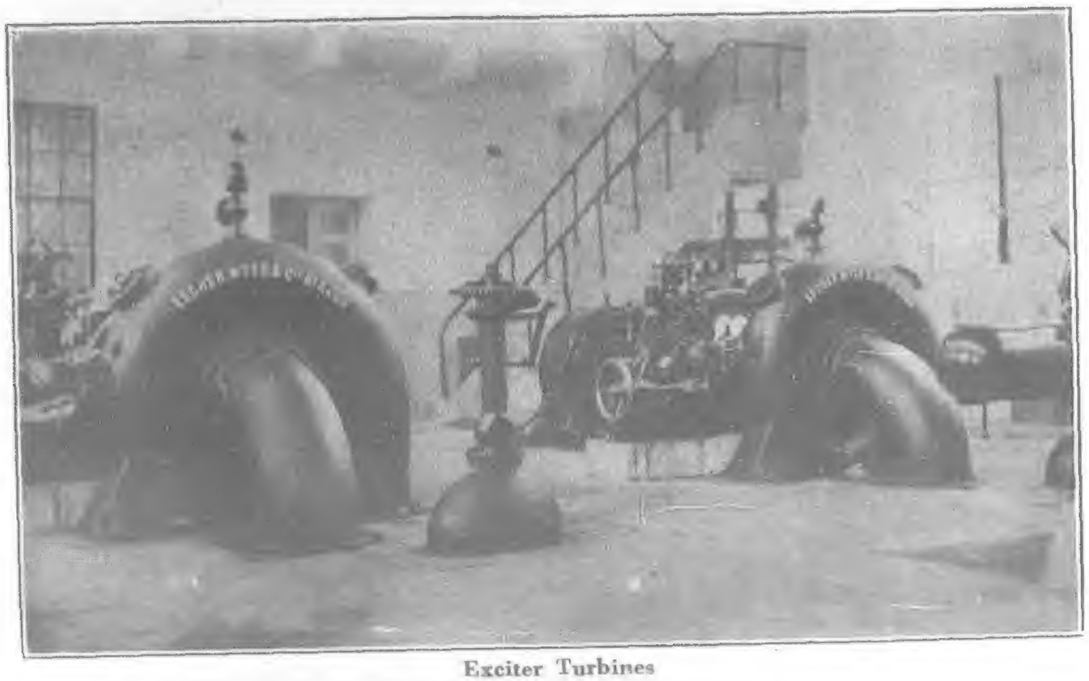
SUHARA POWER STATION OF THE DAIDO ELECTRIC COMPANY.

2 Units, 7·200 H.P., Escher, Wyss & Company Water Turbines and Westinghouse Generators

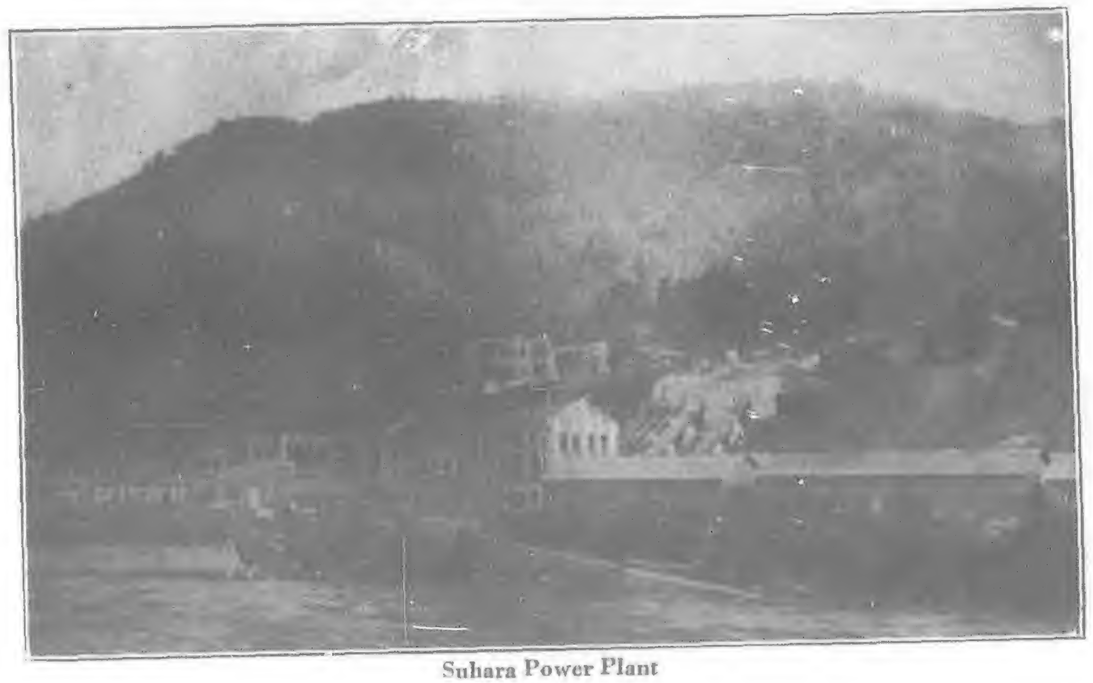




Views of Generating Room



Exciter Turbines

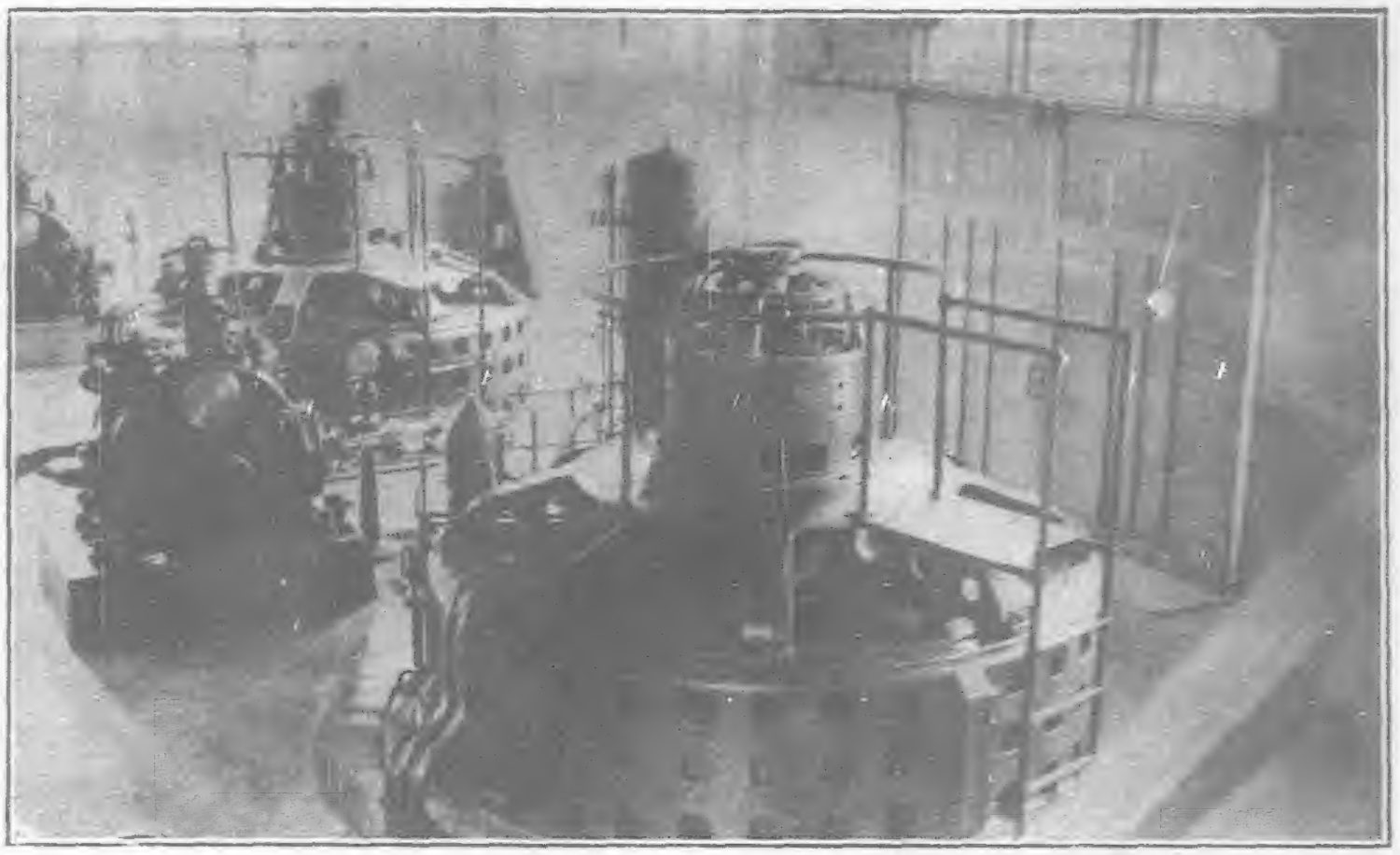


Suhara Power Plant

Osaka Power Supply

In 1909, the Ujigawa Hydro-Electric Company applied for a license to sell power in Tosei-gun, Nishinari-gun, Kita Kawachi-gun, Mishima-gun, and Hone-gun, in the districts around the city of Osaka. This license has only just been granted by the minister of communications. The Osaka Electric Company has also been licensed to supply power in Nishinari-gun, and Naka Kawachi-gun, in the same district about Osaka.

The second large power plant of the Osaka Electric Company at Kusagade, has been completed, enabling this company to be the first of these three competitors to increase its supply to the important Osaka commercial centre. As soon as the power plant on the Kiso River at Dokosho is finished the Daido Denryoku will be able to transmit power to Osaka, and the Ujigawa Suiryoku K. K. will start supply as soon as its Number 2 power plant on the Ujigawa is completed. Severe competition for large company accounts is anticipated to the benefit of power consumers in the Kwansai.



The Ogawara Power Plant of the Kyoto Electric Company, equipped with two 2,750 Escher, Wyss Water Turbines and Westinghouse Generators.

Kyushu Hydro-Electric Equipment

The Kyushu Suiryoku Denki K.K. has recently acquired and is now electrifying the Hokuchiku tramway. In February, 1922, the Japan Electro-Chemical Industrial Co., Ltd., was taken over and the paid-up capital of the Kyushu Suiryoku increased to Y.32,700,-000. The company now supplies a total of 46,000 kilowatts to power users, and 552,000 ten candle-power electric lights.

It has under construction four great power houses ; at Namazuda, one steam plant of 10,000 kilowatts, at Chinda, a hydro-electric plant of 5,500 kilowatts, at Imahata, a hydro-electric plant of 2,200 kilowatts, and at Joshihata another hydro-electric plant of 6,000 kilowatts. It is expected that these will all be completed during 1923, when the company will have a total generating capacity of 60,000 kilowatts, inclusive of present equipment. The coal power plant is to be held in reserve in case there is disastrous fall in water levels during the dry seasons. It is reported that another 10,000 kilowatts coal-burning plant is now under consideration.

Hydro-Electric Company

During the first business term of 1922, this company generated a total of 81,750,000 kilowatts, a decrease of about 1,350,000 kilowatts compared to the second half of 1921, due to the seasonal decrease in water head at the Shimotaki power plant. A coal burning plant is maintained near the city of Tokyo, so that there is no dimunition in the supply of power to the city. The cost of generating power from coal is, however, about twice the cost of generating water power, amounting to about 3.4 sen per kilowatt. This company has a contract with the city of Tokyo whereby it may charge the net cost of any coal generated power it must supply due to the fall in water head. Naturally the need of a new hydro-electric plant is keenly felt.

In 1921, construction was commenced on a plant at Takenosawa, which is nearing completion. Its maximum capacity is 6,700 kilowatts, but when the river is low only half that amount can be generated. The total cost of construction is Y.4,000,000, and the construction cost generate and transmit one kilowatt to the city of Tokyo averages Y.600.

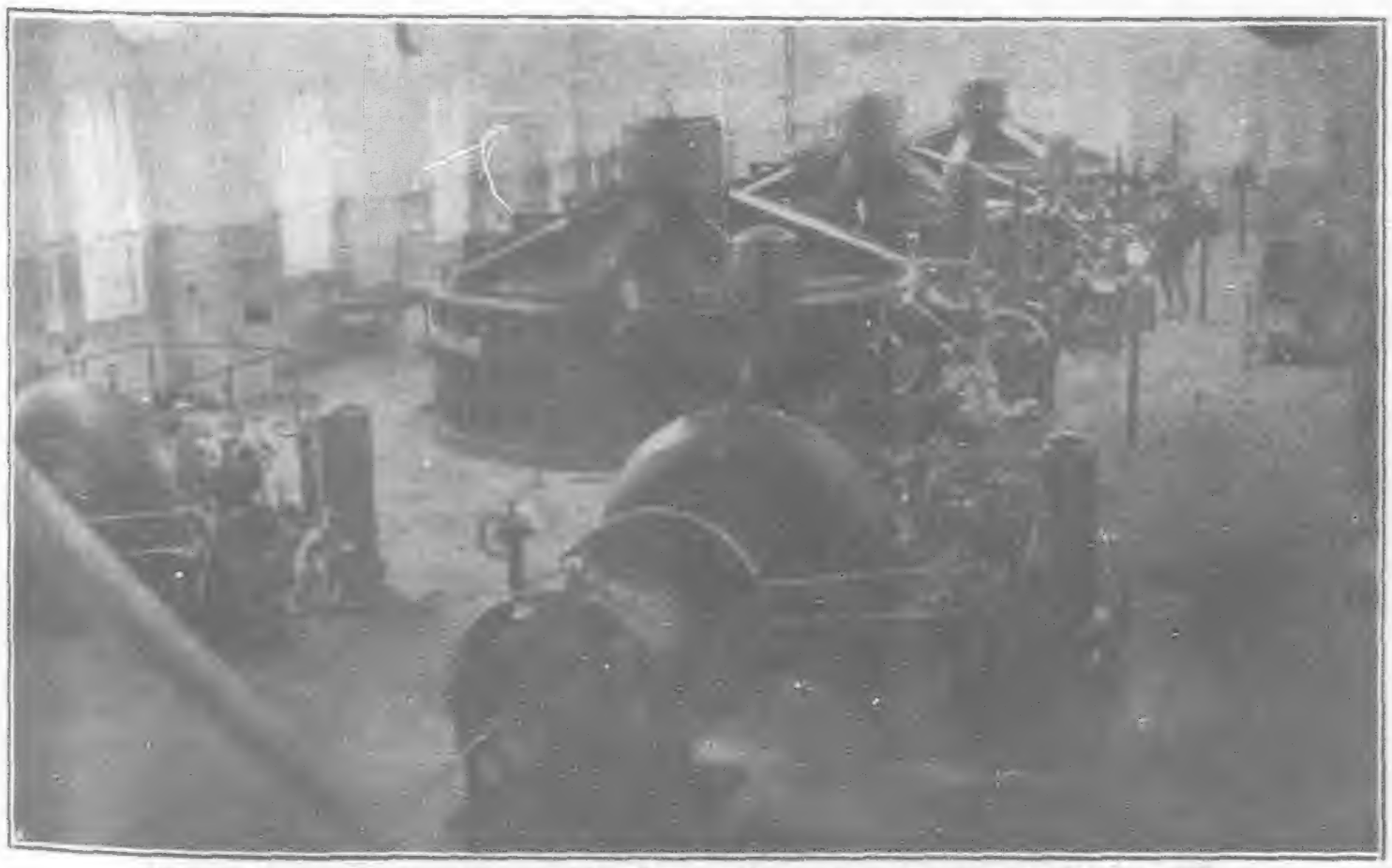
The Kanazawa Electric Tramway Co., Ltd., in Ishikawa prefecture operated its first line of track between Shin Nonoichi and Nomachi, 1.3 miles, and between Nomachi and Nishi Kanazawa, ½ mile, on September 1, 1922.

Tokyo Electric Bureau's Plant

To mitigate the overcrowding on all the trams in Tokyo city, the electric bureau is planning to replace all the small old type tramcars with bogie carriages. This will call for the rebuilding of the bridges in Honjo and Fukagawa districts.

It is planned to build an elevated system for the municipal cars. The routes selected are between Tsukudo Hachiman Mae, and Edogawa Funakawara Bashi, and between Hongo, Masagocho, and Koshikawa, Tomizaka. The lines in these districts are always congested, and the elevated will greatly relieve the pressure of traffic.

The city has just completed a double track line bridge over the Sumida River at Eitai Bashi. This will relieve the pressure of traffic crossing the river, which is daily becoming more and more difficult to handle with the exsiting bridges.



Okuwa Power Plant of the Daido Electric Company, three units Escher, Wyss Water Turbines and Westinghouse Generators.

Electric Express Railway between Kobe and Homeji

The construction of the Meiki Denki Tetsudo K.K., between Himeji and Akashi, is expected to be completed in April, 1923. The promoter of this company Seibei Kawanishi, has obtained a license to construct a high speed railway between Akash

and Hyogo (Kobe), thus completing the line between Kobe and Himeji. As soon as this new line is built it will seriously affect the business of the existing line between Kobe and Akashi, the Hyogo Denki Kido K.K. (Hyogo Electric Tramway Co., Ltd.), which is unable to transform its line into a high speed railway. It is, therefore, confidently expected that a merger of the two concerns will shortly be effected.

Karatsu Electric Railway

The town assembly of Karatsu, in Shiga prefecture, approved the construction of an electric railway within the town boundaries. The work will be carried out on a three-year program, at a total cost of Y.418,000. The main line of the tramway will be over two and a half miles long.

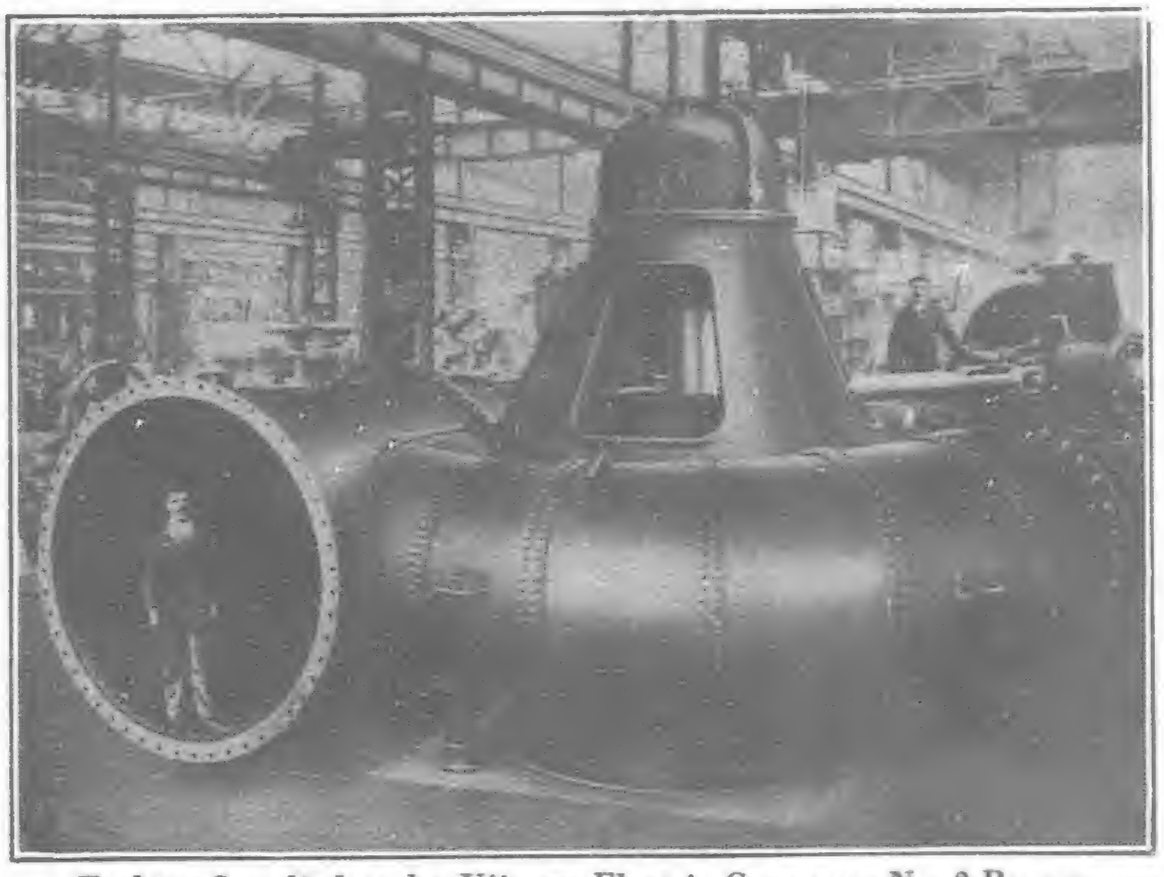
The department of communications granted on October 2, 1922, a license for the amalgamation of the Sagami Denryoku K.K., and the Fuji Suiden K.K. The Fuji Suiden will issue 200,000 shares of stock to be handed the shareholders of the Sagami Denryoku, at the rate of par for par. It is reported that the Odawara Electric Railway will probably be annexed by the Fuji Suiden in the near future. The election of Mr. T. Nakano, president of the Odawara Tramway Co., to the directorate of the new Fuji Suiden points that way.

Tokyo Assembly Approves New Municipal Power Plant

The Tokyo Municipal Tramways consume daily 189,167 kilowatts, a total of 69,042,403 kilowatts a year. The lights and power furnished by the municipal electric bureau consumes another 71,501,627 kilowatts a year. For its own enterprises the city uses another 3,740,262 kilowatts, a grand total of 144,284,242 kilowatts a year. The city owns no hydro-electric power plants of its own but purchases power from the Kinugawa and Katsuragawa power plants of the Tokyo Dento and Kinugawa electric companies.

In 1919, the city assembly approved a plan for erecting a municipal power plant on the Tama River near Tokyo, but only recently provided the necessary funds. The cost of construction of Y.9,900,000 has been approved.

But a complication has arisen in the license recently granted the Tamagawa Hydro-Electric Power Co., to exclusive power rights on the Tama River. Negotiations are now going on which are expected to have a happy result.



Turbine Supplied to the Ujigawa Electric Company, No. 2 Power Plant, 17,000 H.P. by Escher, Wyss & Company, Ltd.

Ujigawa Denki K. K.

The Ujigawa Denki K.K. recently effected a merger with the Kumano Denki K.K., and the Taisho Suiryoku K.K., and increased its authorized capital to Y.85,000,000, of which Y.52,270,000 is paid up. The company took over construction of the Taisho Suiryoku power plants at Otaki, on the Yoshino River, to generate 3,600 kilowatts, and at Miyataki on the same river, to generate 3,000 kilowatts. When these two plants are completed this company expects to enter the Kobe district for the supply of power and light.

A coal-burning power plant at Fukuzaki to generate 10,000 kilowatts, will be completed in April, 1923. By August, 1923, another 26,000 kilowatts of generating capacity will be added. Thereafter, it will be an active competitor of the Daido Denryoku K.K., and the Nihon Denryoku K.K. for business in the Kwansai district.

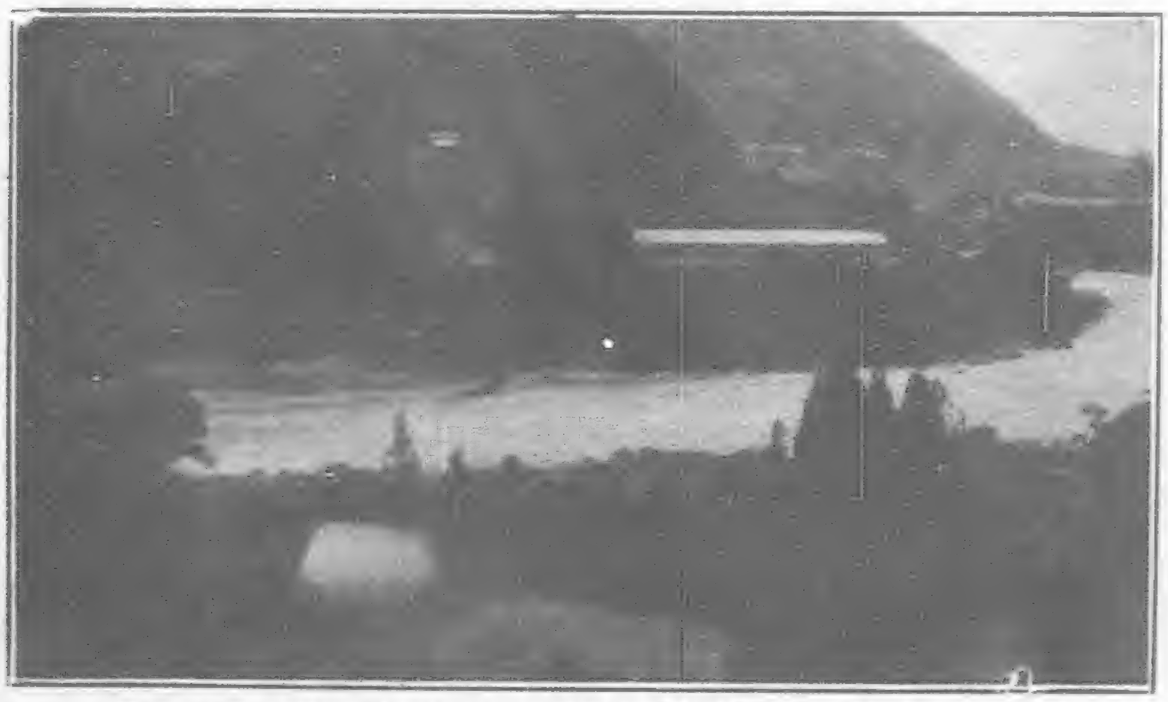
Nihon Denryoku K. K.

This company was originally organized to engage in power supply, with a capital of fifty million yen. It has a hydro-electric power plant at Seto, which will be completed in 1923. It has also applied for licenses to construct power plants at Kosaka, Kukuno, and Masegawa, on the Miyagawa River. A coal burning plant was licensed in May, 1922, to be built at Amagasaki, near Osaka, and the foundation work has been completed.

The company has also obtained permission to build transmission lines to Osaka, Kyoto, Shiga prefecture, Toyama prefecture and Gifu prefecture. Eighty per cent. of the land for the transmission towers, and transmission stations has been purchased. The two transformer stations at Osaka and Sasatsu have already been commenced, and the superstructures are now being erected.

Ikegami Denki Tetsudo K. K.

The Ikegami Electric Railway Co., completed a part of its construction program in September and the line was opened to business October 8, 1922. The purpose of the company is to carry passengers between Omori on the imperial government railways' electric line between Yokohama and Tokyo, and the Honmonji temple of the Nichiren sect of buddhism, at Ikegami. An enormous number of pilgrims annually visits this shrine, and the horse car line formerly operated was absolutely inadequate. The company's rights extend from Omori to Meguro, on the Yamate line outside



Kisogawa (River), Location of the Daido Electric Company's Power Plants.

Foundations for one of the Daido Power Plants on the Kisogawa.

Tokyo city, running through Ikegami, with a branch line between Kamata and Ikegami. It is this branch line, 1 mile 80 chains long which has been opened to business.

The company has two cars of the bogie type, to carry 65 passengers, now in operation, and five other cars being built by the Toyo Denki Seizo K.K. (Toyo Electric Machine Manufacturing Co., Ltd.). The cars weigh 13.5 tons. The motors are also manufactured by the Toyo Denki Seizo K.K., and each car is equipped with two of 50 h.p. each. The air brakes used are from the Westinghouse Air Brake Co.

The power for operation is obtained from the Tokyo Dento station at Ikegami. The company owns one transformer station with a capacity of 700 kilowatts, but only one machine unit of 100 kilowatts is now installed.

The authorized capital is Y.1,850,000 of which Y.533,940 has been paid up. Debentures amounting to Y.63,200 have been issued. The officers are: President, J. Takayanagi; Managing Director, K. Yagi; Directors, K. Ishiguro, Y. Toyama, S. Takei, S. Tanake, H. Kobayashi and S. Kono; Chief Engineer, T. Kumagai.

Head Office; No. 1, 3 chome, Yuraku Cho, Kojimachi Ku, Tokyo (Hibiya Building).

Capitalized at Y.8,000,000, of which Y.2,000,000 has been paid up, the Azumagawa Denryoku K.K., was established in December, 1922 to supply all the power it generates to the Tokyo Dento K.K., which owns 30,000 of the shares issued. The president of the company is Mr. Tetsuo Usui.

The department of home affairs has licensed the project of Miyagi prefecture to unify all the electric enterprises in that prefecture under government control. The costs of purchase and construction are estimated at Y.7,270,000, to be obtained by floating public loans. Interest on the bonds issued will be 8 per cent. During this year Y.4,480,000 will be raised.

It is reported that the Tobu Denryoku K.K., and the Daido Denryoku K.K., two of Japan's largest electric light and power supply companies, have succeeded in raising capital abroad for the extension of their enterprises, through the intermediary of Messrs. Sale & Frazer, of Tokyo.

New Electric Companies

The Tashirogawa Suiryoku Denki K.K., was registered on August 26, 1922, with a capital of Y.5,000,000, one-fourth paid up, to engage in the sale of electric machinery, and invest in power companies.

Head office, No. 1, 1 chome, Yuraku Cho, Kojimachi Ku, Tokyo. Directors, S. Kubota, M. Soejima, K. Morita and G. Hayase; Auditors, S. Maeda and Y. Maeda.

Tosa Denki K. K.

By amalgamation of the Tose Electric Railway Co. and the Tosa Hydro-Electric Power Co., Ltd., the Tosa Electric Co., was registered August 9, 1922 with a capital of Y.6,000,000. Of the issue of 120,000 shares, 80,000 are fully paid up, and 40,000, half paid up. The head office is at 331 Honcho, Kochi city, Kochi prefecture. The company will operate electric railways, supply light and power, deal in electric machinery and machine tools, design and contract for construction of electric enterprises, and manufacture electro-chemicals.

The officers are: Directors, T. Uda, K. Nonaka, U. Kataoka, K. Nishiyama, K. Yokoyama, J. Mori, M. Chizu and T. Ueda.

Imazu Hatsuden K. K.

With the object of supplying power to the Hanshin Kyuko K.K. (Kobe-Osaka Express Electric Railway Co.), and the Ujigawa Denki K.K., the Imazu Power Generating Co., Ltd., was organized in August, 1922, with a capital of Y.3,000,000, all paid up. Its main office is at 325 Sumida-machi, Kitano, Kita Ku, Osaka city, care the Hanshin Kyuko K.K. The officers are: Directors, T. Hayami, N. Ueda, K. Kishi, Y. Oka and S. Kamimura (managing director).

Yubetsugawa Suiryoku Denki K. K.

With a capital of Y.700,000, one-fourth paid up, this company was established August 16, 1922, to supply light and power and to deal in electric machinery. Its officers are: Directors, Y. Anamizu, K. Anamizu, T. Yajima and K. Oishi; Auditors, T. Takahashi and K. Kondo. Its head office has not yet been selected, but the company may be addressed in care of the electric bureau, department of communications, Tokyo.

Gyokunan Tetsudo K. K.

Under the provisions of the private railway laws, the Gyokunan Railway Co., Ltd., was established on July 27, 1922, as a co-operating concern with the Keio Densha K.K., operating in the suburbs of Tokyo city. The capital is Y.1,500,000, of which Y.150,000 has been paid up. Its head office is at 66 Honmachi, Hachioji, Tokyo prefecture. The compay will operate a trackless electric tram system in the city of Hachioji, and transport both passengers and freight. The officers are: Directors, T. Inouye, T. Shimada, Z. Morikubo, S. Shibuya, T. Watanabe and S. Aoki.

Suwa Denki Kido, K. K.

The Suwa Denki Kido K.K. (Suwa Electric Tramway Co., Ltd.), was licensed on October 7, 1922, to built an electric railway between Hirano-mura, Suwa-gun, Nagano prefecture, and Miyagawa-mura, Suwa-gun, Nagano prefecture, a distance of 9 miles. The line will be 3 feet 6 inch gauge, and the cost of construction is estimated at Y.2,400,000.

Minobu San Denki Tetsudo K. K.

A license to construct an electric railway between Ono, Minobu-mura, Minami Koma-gun, Yamanashi prefecture, and Minobu, of the same district, a distance of two miles, was granted to the Minobu San Denki Tetsudo K.K., (Mt. Minobu Electric Railway Co., Ltd.) on October 12, 1922. The gauge of the track will be 3 feet 6 inches, and the cost of construction is estimated at Y.600,000.

Seiho Tetsudo K. K.

(Seiho Railway Co., Ltd.) Licensed October 16, 1922, to construct an electric railway between Sakae-machi, Imadate-gun, Fukui prefecture, and Oda-mura, Niu-gun, Fukui prefecture. Length of line: 10 miles, 5 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.800,000.

Nogami Keiben Tetsudo K. K.

Licensed October 16, 1922, to construct an electric railway between Higashi Nogami-mura, Nasu-gun, Wakayama prefecture, and Shimo Kanno-mura, Nasu-gun, same prefecture. Length of line: 4 miles, 30 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.400,000.

Osaka Tetsudo K. K.

Licensed October, 1922, to extend its steam and electric railway from Kashiwabara-machi, Minami Kawachi-gun, Osaka prefecture, to Tomorogo-mura, Kita Kawachi-gun, same prefecture. Length of line: 10 miles, 5 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.1,800,000.

General View of Imperial Japanese Government Steel Works at Yawata, Kyushu

Japan's Iron and Steel Industry

By H. C. Huggins

WITH all the advance in equipment and technique made in her iron and steel industry in the last twenty years, Japan remains practically dependent on other countries for the major part of its iron and steel supplies. This is due entirely to the basic lack of sufficient high grade ore to furnish raw material for an industry of magnitude great enough to produce all the nation's requirements. In 1909, it was estimated that there were only 60,000,000 tons of iron ore fit for reduction by present day processes which could be mined in Japan. There are no recent surveys which could add anything to that estimate. Chosen (Korea) has a visible supply of 30,000,000 tons, but of ore of even lower grade than the average Japanese supply.

The industry is also handicapped by the diminishing supply of coal. The main coal fields of Japan begin to show signs of having reached the end of possible developments. So acute is the coal problem to the iron industry that a bill to provide Y.16,000,000 for the complete electrification of the government steel mills at Yawata, Kynshu, has been prepared by the imperial department of agriculture and commerce, for presentation during the present session of the imperial diet. The plan is well considered and favored by the government, so the bill is almost certain of approval. The cost of the change is to be borne by profits of operation. Another disadvantage the industry labors under is the difficulty of transportation from the large mills to the centres of consumption. The Yawata Steel Works (the government mills) are located in Kyushu, 500 miles from Osaka their nearest important market. The principal market of the Japan steel works whose mills are located in the Hokkaido, is Tokyo, some 600 miles from the mills. The principle of the iron trade that the ore seeks the fuel has centered Japan's steel mills in strange places. Cheap transportation to the markets is therefore impossible to obtain, because of the many times each piece of finished material must be handled in transhipments before it reaches its final market.

The supply of iron ore being so limited, there are only four mills in Japan operating on Japanese ores alone, the Kamaishi, Ninita, Sennin and Kuriki. All the other mills depend upon China, Manchuria and Chosen for an adequate supply of ore, even in this time of depression. The annual deficit in the supply of finished steel materials is between 400,000 and 500,000 tons, which is imported from England, the United States and China.

The domestic demand for iron and steel is nevertheless largely supplied by the domestic mills, and it is steadily increasing year after year. At the end of 1921, the pig iron productive capacity of the Japanese blast furnaces was :

Japan Proper	3,040 tons a day
Chosen	300 ,, ,,
Manchuria	800 ,, ,,
	4,140 tons a day

Estimating 330 operating days a year, the annual capacity amounts to 1,366,200 tons. (There have been no additions to equipment since 1921.)

The productive capacity of the steel rolling mills at the end of 1921 was 2,153,250 tons a year. The Yawata Steel Works possesses rotary retorts which can produce 1,000 tons of steel billets a day. But the greatest part of the annual output is produced in single furnaces in small mills. The following table shows the productive capacity of Japan's chief rolling mills :—

Steel billets, slabs, etc.	787,750 metric tons.
Steel plates	396,000 ,,
Steel heavy rails	90,000 ,,
Steel wire	114,500 ,,
Steel tubes	61,000 ,,
Total	..1,449,250 tons a year

It can be seen that Japan's mills are able to produce all the iron and steel the nation needs and even more. The department of agriculture and commerce made a survey of steel operations in

1921, and published the following forecast of future production :—

JAPAN PROPER

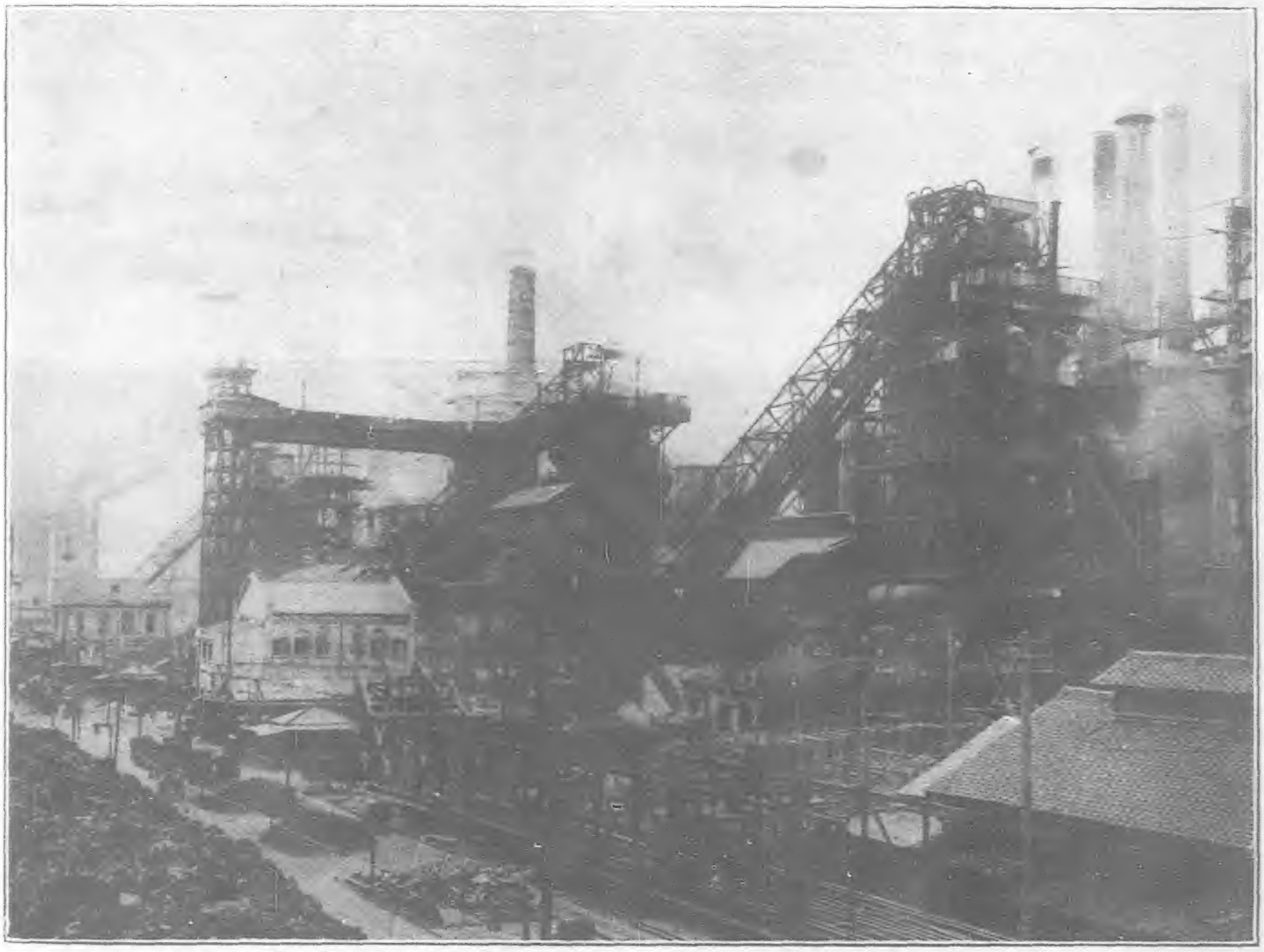
	Pig Iron Tons	Steel Billets Tons	Steel Shapes Tons
1921	1,060,000	1,920,000	1,400,000
1922	1,110,000	2,000,000	1,470,000
1923	1,150,000	2,030,000	1,490,000
CHOSEN			
1921	100,000	50,000	40,000
1922	same		
1923	same		
MANCHURIA			
1921	250,000	60,000	50,000
1922	250,000	60,000	50,000
1923	350,000	60,000	50,000
TOTAL			
1921	1,410,000	2,030,000	1,490,000
1922	1,460,000	2,110,000	1,560,000
1923	1,500,000	2,140,000	1,580,000

PIG IRON

	Domestic Output Tons	Imports Tons	Total Tons	Exports Tons	Balance Tons	Percentage of domestic demand satisfied by domestic manufacture %
1914	299,461	172,134	471,595	1,388	471,408	63
1917	462,792	135,082	697,874	3,322	694,552	62
1918	606,428	267,741	874,169	1,146	873,023	70
1919	612,609	352,151	964,760	1,894	962,866	64
1920	529,875	390,298	920,173	2,201	917,972	58
1921	483,701	276,284	759,985	—	—	—

STEEL SHAPES, ETC.

1914	282,516	408,467	670,983	29,622	661,361	43
1917	513,445	673,210	1,186,655	51,735	1,134,916	45
1918	539,637	650,780	1,190,417	61,007	1,129,410	48
1919	552,601	725,244	1,277,845	105,240	1,172,605	47
1920	537,461	1,039,452	1,576,913	70,761	1,496,152	36
1921	557,800	636,801	1,204,601	85,218	1,119,383	50



Blast Furnaces of the Imperial Japanese Government Steel Works at Yawata

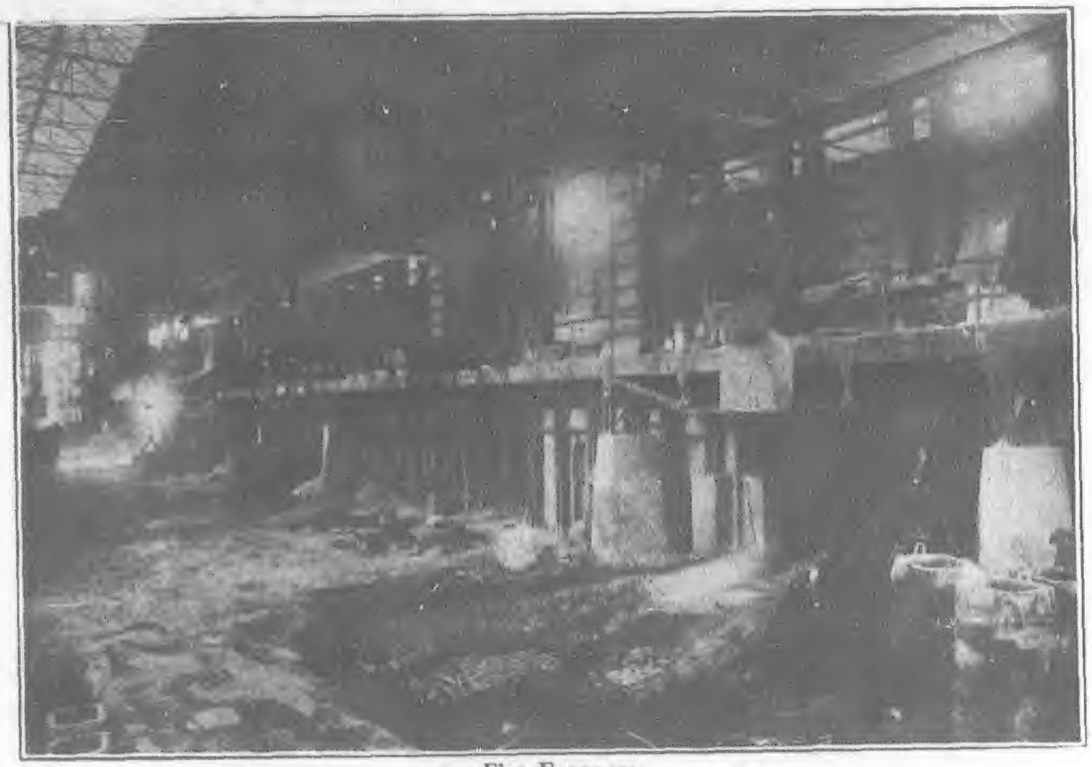
This table shows a very marked increase in production each year, but it is to be doubted if these figures have been any where near reached by the business of the past two years, and with the continuing depression in industrial circles there will not be any such production in 1923 as this table indicates.

Another table prepared by the department of agriculture and commerce makes an estimate of the Japanese demand for pig iron and finished steel materials, and shows the percentage of demand satisfied by domestic production, from 1914 to 1921.

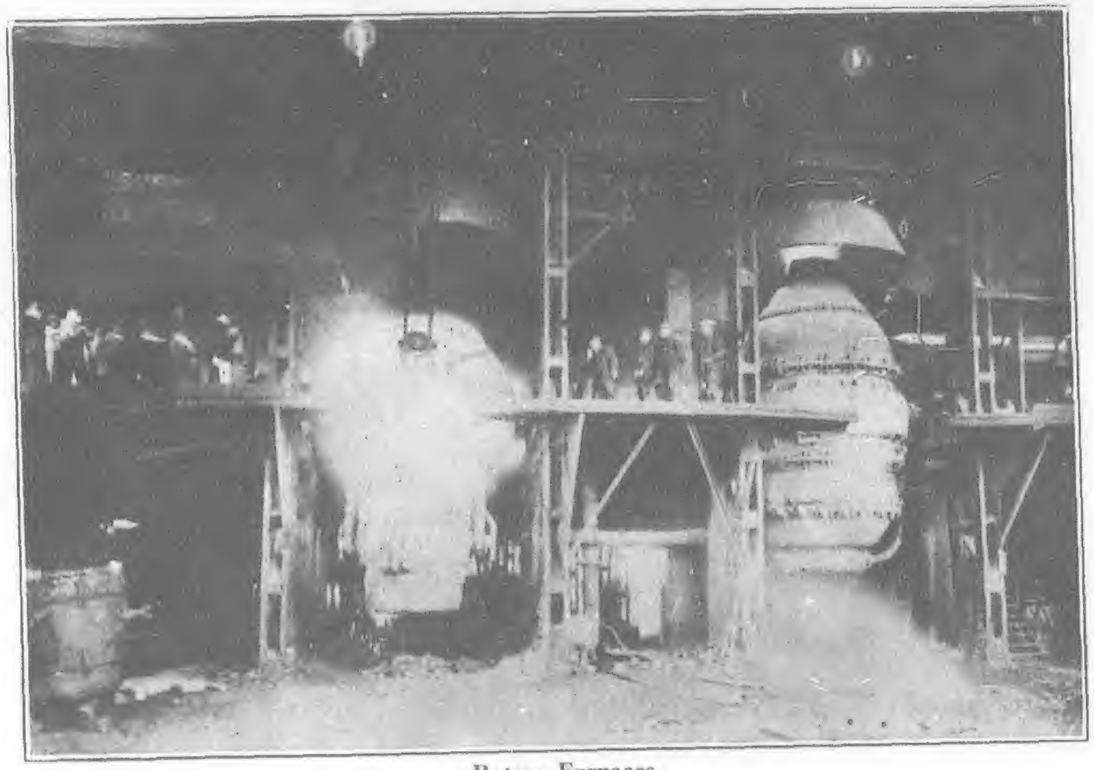
During the war and because of the great profits to be made in steel speculation, Japanese imports of steel were greatly in excess of any need of the country itself. Therefore these figures are to be taken at their face value only, and should not be construed as offering any real guide to the Japanese actual domestic demand for pig iron and finished steel materials.

The United States during the war became the principal seller of steel to Japan. Despite feverish post-war competition with English and German manufactures, the United States still continues

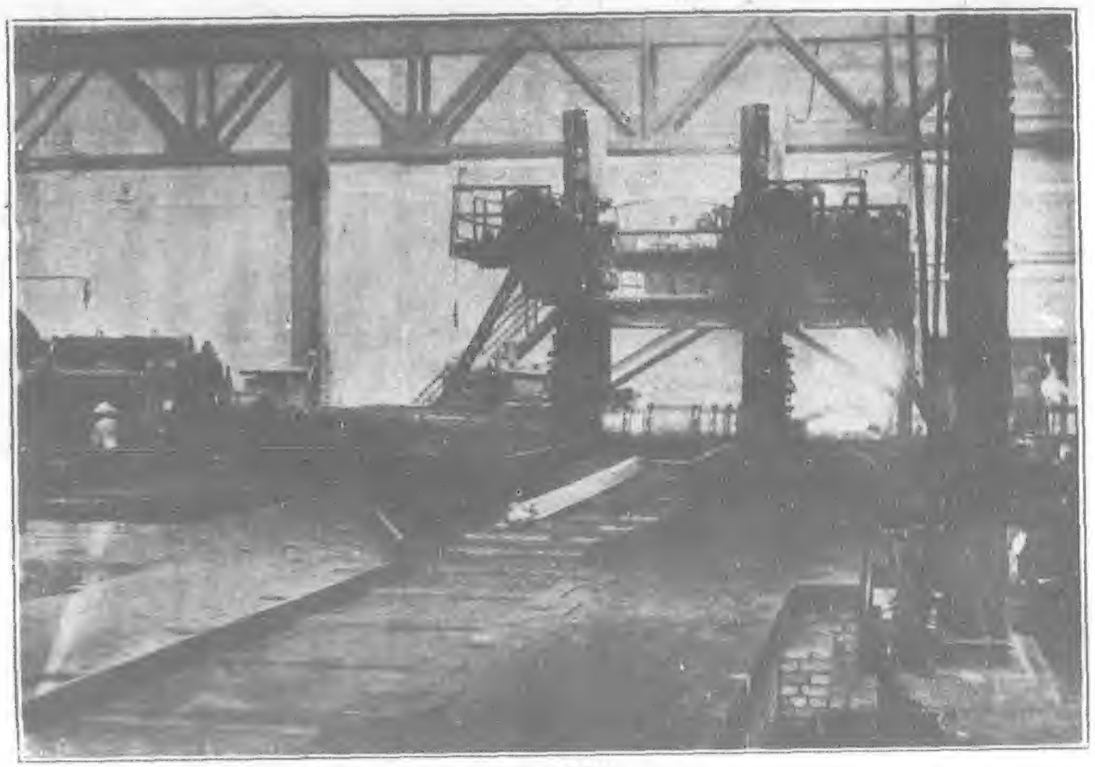
IMPERIAL JAPANESE GOVERNMENT STEEL WORKS AT YAWATA, KYUSHU



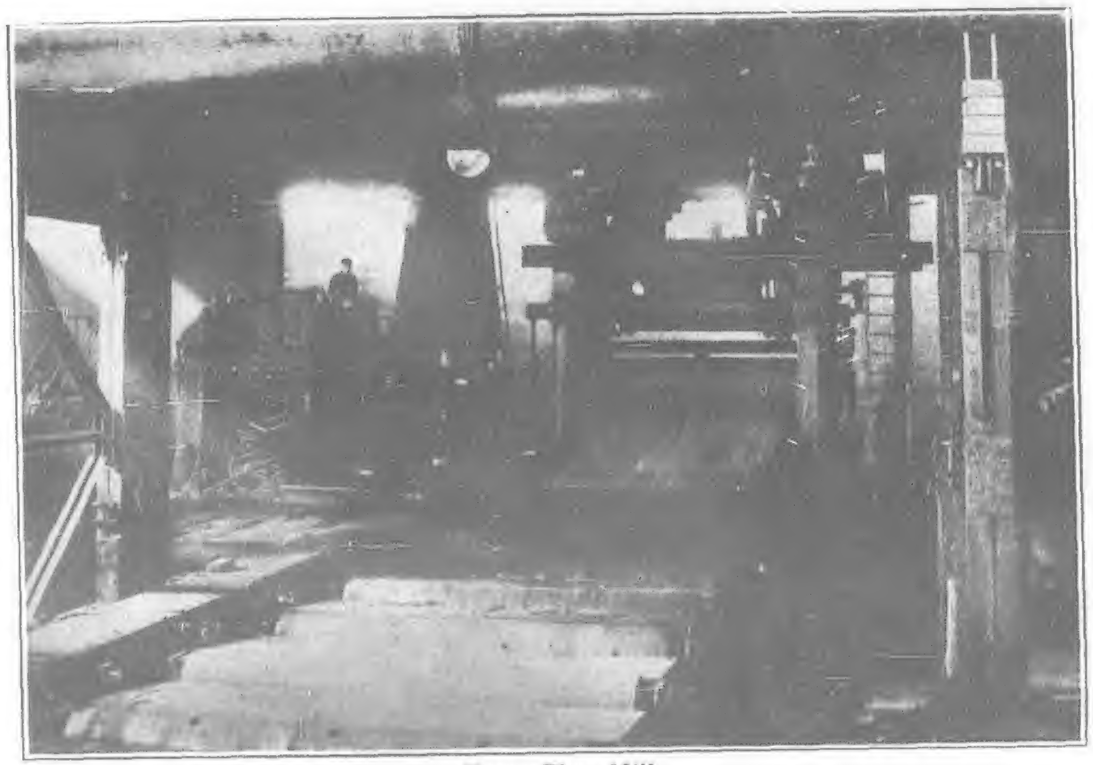
Flat Furnaces



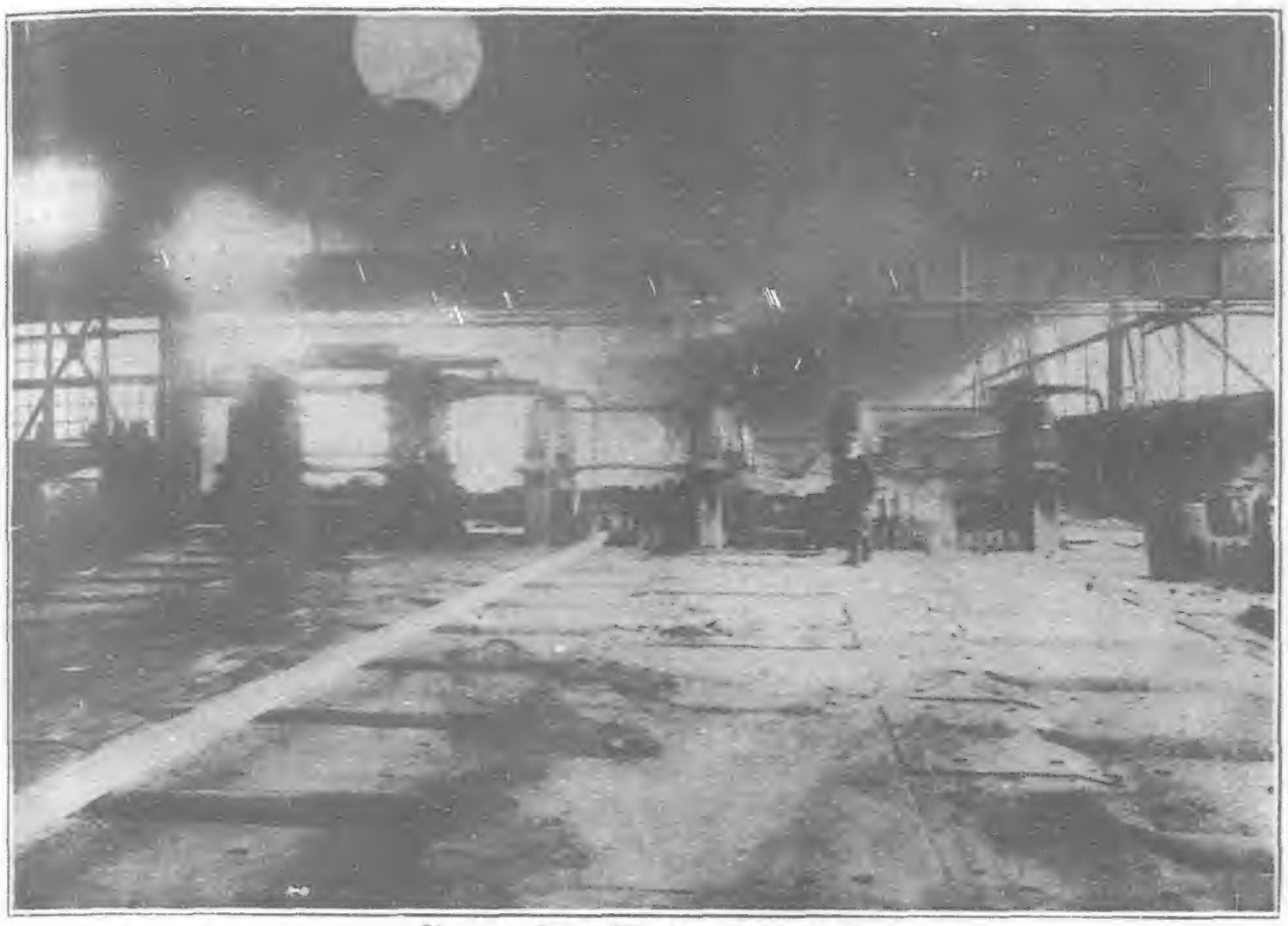
Rotary Furnaces



Ingot Mill



Heavy Plate Mill



Yawata Steel Works: Rail Mills

to supply about two-thirds of the Japanese steel requirements, and bids fair to retain its position as a seller to Japan for many years to come. Imports of iron and steel into Japan according to countries of origin for 1919, 1920 and 1921 are given below (in tons):

		1921	1920	1919
China	P	76,160	14,740	95,189
	S	1,174	12,397	1,071
Great Britain	P	22,628	58,565	44,762
	S	98,517	140,568	69,882
Germany	P	3,444	500	—
	S	39,252	1,885	
Sweden	P	18,065	14,158	10,783
	S	4,064	3,661	3,474
United States	P	1,247	35,512	35,560
	S	455,015	857,822	645,520
British India	P	34,351	47,921	28,860
Others	P	71,196	51,252	68,011
	S	27,607	8,410	1,714
Total	P	227,092	348,648	283,165
	S	625,629	1,024,743	721,761

(P=Pig Iron. S=Steel).

There is no chance of mistaking the fact that Japan's steel industry is equipped to produce at least twice the actual present day requirements of the country's industries and builders. It is therefore little to be wondered at that the industry as a whole is now facing a period of reaction and adjustment. Loud cries are heard for a merger of all interests, both private and official. But such a merger stands little chance of success unless it includes the Yawata Steel Works, which supplies practically 75 per cent. of all Japan's domestically produced iron and steel materials.

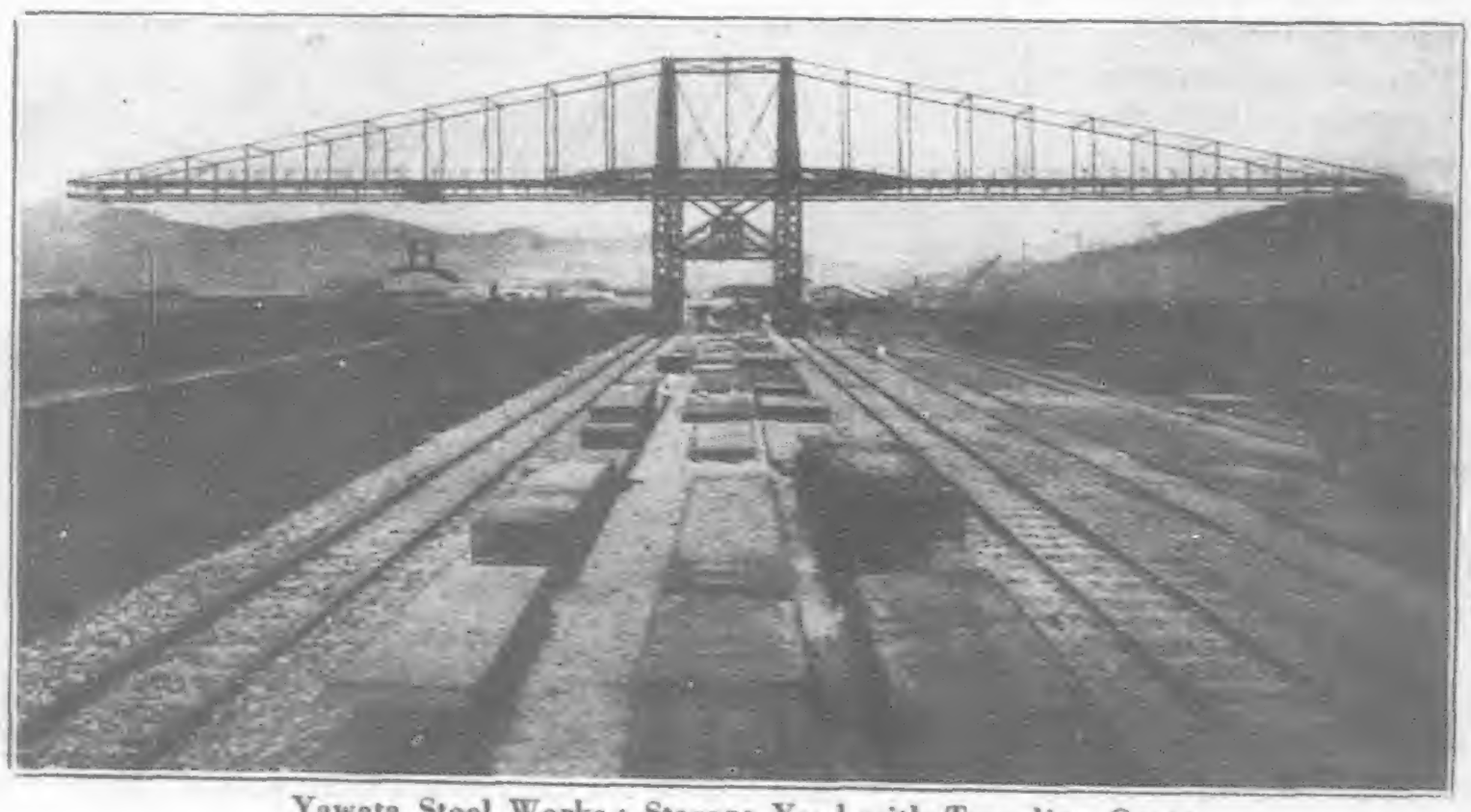
Historically considered, except for the period of the European war, the Japanese iron and steel industry has always been more or less on or near the rocks of complete collapse. The first iron works in Japan were government owned, and rapidly proved a hopeless failure. They were then transferred to private interests, which were no more successful than the government had been. In 1896 the Yawata Steel Works were approved by the diet, and were completed and opened to business in 1901 in time to prove of immense service to the nation during the Russo-Japanese war.

The general stimulation of manufacturing industries brought about by the Russo-Japanese war boomed iron and steel manufacturing and especially shipbuilding and the manufacture of arms. During the war the Kobe Steel Works, the Sumitomo Steel Works, the Hyogo mill of the Kawasaki Dockyard Co., the Japan Steel Works, were all established to meet the demands of the day. Except the last named, these were all on a small scale, and not one of them was equipped with rolling mill machinery. In 1913 the whole production of pig iron in Japan amounted to 243,000 tons, of steel 255,000 tons. Seventy per cent. of the pig iron and 85 per cent. of the steel shapes were produced in the Yawata Steel Mills, the government property.

The European war, with its embargoes on steel, exports, drove the Japanese to increasing their steel productive capacity. High prices of steel materials made capitalists run a mad race to share in the profits, and equipment utterly unsuited to the technical ability of the workmen, and the managers even, was hastily installed in existing mills, and new steel companies sprang up over night to share in the glorious business of war-time. Under war-time pressure the productive capacity of Japanese blast furnaces had increased to 612,000 tons by 1919, and the steel mills had a rolling capacity of 552,000 tons. Adding the productive capacity of Japan, of Chosen and Manchuria, the total pig iron capacity rose to 787,000 tons, and the steel shape productive capacity to 557,000 tons. More than Y.500,000,000 were invested in steel mills, and over a half million men were employed in the industry.

But the after the war reaction very materially affected the prosperity of Japan's steel mills. Small companies established in a period of prosperity at high costs of equipment, were hurriedly closed down. Many mills had not even completed installing their equipment. The heavy purchases of iron and steel made in the winter of 1919 and spring of 1920, largely contributed to cause the panic of April, 1920. And the huge stocks on hand after that brought prices down to panic levels, and all the mills still operating reduced production to the very lowest possible. And then on top of all these troubles came the Washington conference which limited armaments, and also the sales possibilities of the Japanese mills.

The pig iron producers were the hardest hit. There are 19 furnaces in Japan with a capacity of more than 100 tons each.



Yawata Steel Works: Storage Yard with Traveling Crane

Only ten are now in operation, and at reduced outputs at that. There is only one furnace of less than 100 tons, out of a total of 23 now in operation.

The following table shows the number of furnaces owned by the principal pig iron producers, and their capacity, at the end of 1921:—

Mill	Capacity	Number Furnaces	Number in operation.
Yawata Steel Works ..	100 tons	6	5
Toyo Steel Works ..	100	2	1
Kamaishi Mining ..	100	2	1
	Under 100 tons	7	0
Wanishi Works	100 tons	3	0
	Under 100 tons	1	1
Others	Under 100 tons	13	0
Total, in Japan Proper:			
	100 tons and over	13	7
	100 tons under	21	1
Kenjiho, Manchuria ..	100 tons over	2	2
Honkeiko, Manchuria ..	100 tons over	2	0
	100 tons under	2	0
South Manchuria Railway	100 tons over	2	1
Total, all	100 tons over	19	10
	100 tons under	23	1

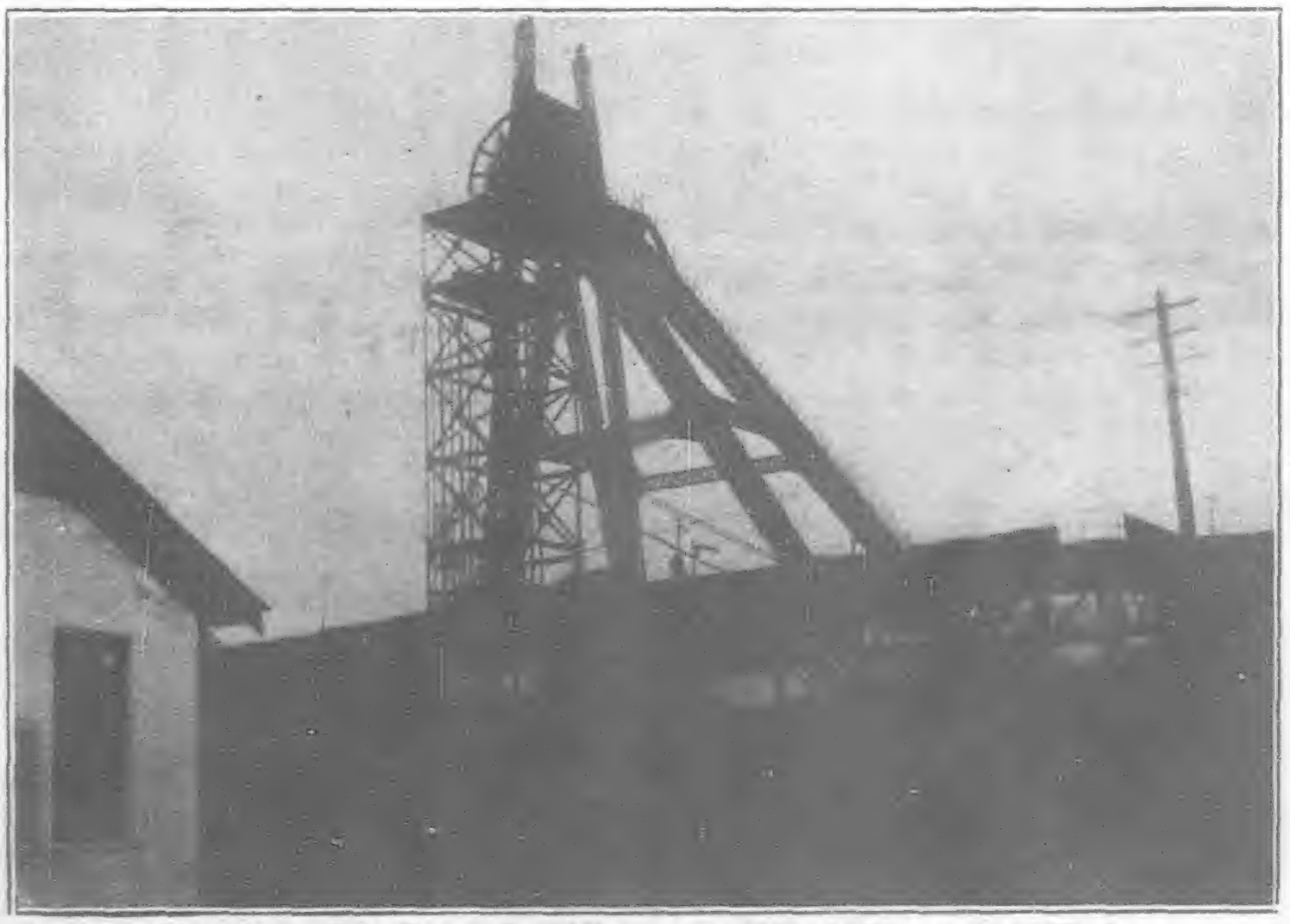
Depression has not been so severe in the steel shape industry as it has been in the pig iron industry. The Japanese navy bought Japanese-made materials up to the limit of possibility, and the boom in building in Tokyo and Osaka helped largely to dispose of great stocks of building shapes, and opened a new market for new materials of domestic manufacture. The steel manufacturing interests are therefore able to make both ends meet, so that most of these mills are able to operate on part time. The limitation of armaments, however, dealt a blow from which they have not been able to recover. Particularly severe was this blow to the Nihon Seiko Sha, the Fukuai Mill of the Kawasaki Dockyard Co., the Kenjiho Mill of the Mitsubishi interests, the Kobe Steel Works, and the Asano Shipbuilding Co., plate mill.

Of the thirteen leading companies engaged in iron and steel manufacture to-day, six of them all showed losses in the first half of 1921, and in 1922 also. The total capital of these companies is Y.154,666,000, and their outstanding unpaid obligations amount to more than Y.100.000,000.

Official Statistics

The latest published report on the iron and steel production of Japan was made by the imperial department of agriculture and commerce in November, 1922, for conditions at the end of 1921.

There were 64 blast furnaces in Japan, December 31, 1921, with a capacity of 1,412,070 tons, figuring 330 working days, to the year; 104 horizontal furnaces for steel refining, capacity, 1,482,600 tons, 300 working days in a year, each furnace working to capacity twice in 24 hours.



Head Gear of the Futase Coal Mine, operated by the Yawata Steel Works

With the exception of two 10-ton rotary furnaces owned by the Yawata Steel Works, all the rotary furnaces in Japan are for casting only. These two furnaces produce something like 300,000 tons a year, pouring 50 times in 24 hours, operating 300 days a year. Adding this 300,000 tons to the total produced in the horizontal furnaces, the grand total of steel production (potential) in Japan at the end of 1921 was 1,782,600 tons in a year of 300 days.

NUMBER AND CAPACITY OF FURNACES, END 1921

Capacity	Number	Capacity	Number
300 tons	1	35 tons	1
270 ,,	2	30 ,,	2
250 ,,	3	25 ,,	4
220 ,,	2	20 ,,	13
215 ,,	1	18 ,,	1
150 ,,	2	15 ,,	3
130 ,,	2	12 ,,	1
120 ,,	2	10 ,,	1
100 ,,	3	7 ,,	2
60 ,,	1	5 ,,	14
50 ,,	2		
		Total	64

This number, however, does not include 102 electric furnaces of varying capacity, in use in many different industries.

NUMBER AND CAPACITY OF STEEL CONVERTERS

Horizontal Type.		*Rotary Type.*	
Capacity	Number	Capacity	Number
60 tons	4	10 tons	2
50 ,,	10	2½ ,,	2
40 ,,	1	2 ,,	5
25 ,,	52	1½ ,,	2
15 ,,	13	1 ,,	1
10 ,,	7	0.95 ,,	1
8 ,,	7	0.9 ,,	1
7 ,,	3	0.8 ,,	1
6 ,,	3	0.7 ,,	1
5 ,,	6	0.5 ,,	2
4 ,,	1		
3 ,,	1	Total	18
Total	107		

In addition, there are 51 crucible furnaces, and 42 electric furnaces for producing steel. Both of these tables include the furnaces at the Anzan Iron Works of the South Manchurian Railway, in Manchuria. From the end of 1921, to the present time, practically no changes have been made in the equipment of Japanese steel mills.

The table on next page shows the percentage of the total productive capacity which is official and private:—

MANUFACTURING CAPACITY

Pig Iron :			
Total	1,412,000 tons		100%
Official Mills	400,000 ,,		28%
Private Mills	1,012,000 ,,		72%
Steel :			
Total	1,783,000 tons		100%
Official Mills	750,000 ,,		42%
Private Mills	1,033,000 ,,		58%
Spring Steel	787,750 ,,		
Plates	396,000 ,,		
Rails	90,000 ,,		
Wire	114,500 ,,		
Tubes	61,000 ,,		
Total ..	1,449,250 tons.		

It is instructing to compare these capacity tables with those for actual production in recent years. The actual production of pig iron has not been more than 47 per cent. of the authorized capacity ; and the production of steel has been about 40 per cent. of capacity. About 61 per cent. of the pig iron was produced by the government works, and 54 per cent. of the steel. In other words, owing to the depressed industrial conditions more than 70 per cent. of the private capacity lies idle.

OUTPUT OF PIG IRON IN TONS.

	1920	1921	First Half 1922
Japan	521,036	475,947	—
Chosen	84,118	83,010	—
Total	605,154	558,947	341,429
Manchuria	116,037	93,951	—
Iron Alloys	8,839	7,574	4,633
Total, excluding Manchuria	613,993	566,531	346,062

OUTPUT OF STEEL IN TONS

	1920	1921	First Half 1922
Rolled Steel:			
Japan	456,160	479,783	—
Chosen	26,419	30,026	292,689
Forged Steel	48,804	35,902	13,769
Cast Steel	29,687	30,143	19,746
Special Steels	2,810	11,972	326
Total	563,880	557,826	326,530

Yawata Steel Works: Coal Washing Plant and Coke Works

Yawata Steel Works: Sea Water Tank, 2.000 cubic metres capacity

Japan's Great Government Steel Mills

The necessity of a national steel industry was early apparent to the imperial Japanese government and an attempt was made in 1891 to obtain the approval of the imperial diet for the establishment of a steel mill under government direction. But because of the insufficient data available on the iron deposits of the country the bill was rejected by the diet, which, however, approved a plan for the organization of a society for the investigation of the iron deposits of the nation.

The need of a domestic steel industry was made more apparent when the Sino-Japanese war broke out. In 1895 the imperial diet without opposition approved a bill providing for the construction of a 90,000 tons capacity steel mill to be government operated. The initial budget appropriated Y.4,095,793.40 for the plan. The village of Yawata, Onga-gun, Fukuoka prefecture, Kyushu, was decided on as the site of the mills.

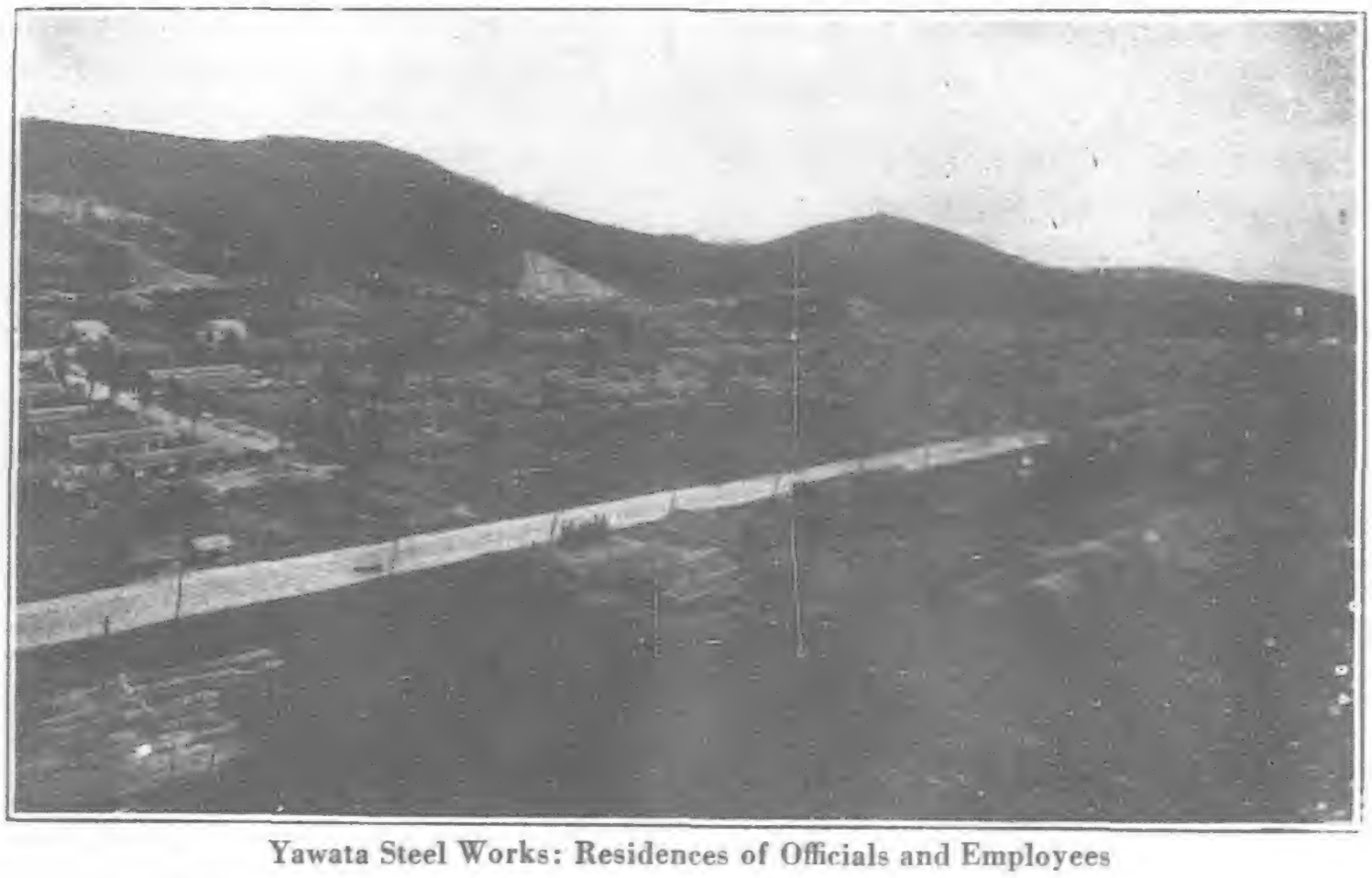
It did not take long to discover that the original appropriation was utterly insufficient for the purpose, and in several later sessions of the diet the sum of Y.15,841,016,851 was voted to defray necessary costs of construction. The first blast furnace was completed on February 5, 1901, and the manufacture of pig iron commenced in May of the same year. Other parts of the complete mill were opened up from time to time, but there were always many difficulties to be overcome, largely caused by the inefficiencies of the management. But because of the needs of the country during the Russo-Japanese war, an extraordinary budget of Y.4,696,126 was granted, and with this many improvements of equipment and technique were effected. During the war the demand for the manufactures of the works increased to an enormous extent, and it was impossible to supply all needs.

The great boom in manufacturing industries after the Russo-Japanese war maintained the demand for steel, and to meet the growing national demand it was planned to increase the works capacity to 180,000 tons. In 1906 the diet approved the costs of the expansion amounting, for the first term of construction, to Y.10,880,000. Work was commenced in 1906, and completed in 1909. Demand increased, and before long the plan for expansion had grown to a 350,000 tons mill. Another appropriation was made to cover construction for a period of five years from 1910, a total of Y.12,389,929 being approved by the diet. Later the government

approved an appropriation of Y.3,760,000 for the construction of a benzine distillery, and the No. 2 heavy plate mill.

Before the European war the domestic demand for iron and steel amounted to about 1,300,000 tons a year. This was much beyond the manufacturing capacity of the Japanese mills. To bring production up to demand the Yawata Steel Mill authorities planned to increase the equipment to produce 650,000 tons. The diet approved a sum of Y.34,515,450 to be used in six years for this purpose. Construction was begun in 1916. But meanwhile the demand for steel increased at such a rate that the steel works requested sanction to complete the expansion in less time than the appropriation permitted. The government granted approval for completion in 1920, but the rise in the costs of materials made in impossible to carry out the plans with the sum allowed. Accordingly Y.11,805,500 was granted for the increased cost. Besides these expansions the mills decided to construct a 100,000 tons steel plate mill at a cost of Y.15,672,000.

Yawata Steel Works: Loading Pier



Yawata Steel Works: Residences of Officials and Employees

With these great expansions of the capacity of the mills, it became necessary to consider a constant supply of ore. In 1919 the diet, therefore, approved the expenditure of Y.700,000 to purchase iron fields abroad, from which ore could be shipped to the mills for reduction, at not too high costs in freight charges.

The difficulties of obtaining workmen during the war, and also delays in obtaining equipment from abroad, retarded all construction plans. The completion was finally postponed to 1922, and the diet allowed Y.108,888 extra for the salaries of officials who would have to be retained until the construction works were completed.

In 1920, the total investment in all the works of the Yawata Steel Works, amounted to Y.98,754,151.

Process of Manufacture

The smelting operations are carried on throughout the year without ceasing. The ore is fed into the blast furnaces together with the lime and coke, and reduced by hot air blasts. The reduced metal is transferred to the mixing furnaces, where the quality of the steel to be produced is determined, and then is transferred to either a horizontal type, or rotary furnace. The reduced metal which is not transferred to the mixing furnace is poured into pigs, which are used for castings, or steel production in the horizontal furnaces. The slag is made into bricks, and used as raw material for cement.

Gas discharged from the furnace is washed and used for operating gas furnaces, gas boilers, and hot air furnaces. Gas produced in the coke making furnace is used for the production of ammonium sulphate, tar, benzine, etc. From the coal tar, bye-product, tar oil, napthalene, etc., are manufactured. The same gases used to heat the coke furnace are also used for heating the steel ingots and steel plates for rolling. Part of the gas is further refined, and is used in the research laboratories, and hospital for illuminating. A slight surplus is sold in the city.

Ordinary steel is produced in the rotary and horizontal furnaces. Special steels are manufactured in crucible, or electric furnaces. At the rotary furnaces, the mixed metals are subjected to a hot air blast, and the refined material is cast into desired shapes, such as rails, etc. At the horizontal furnaces, cold pig is mixed with the hot mixture from the mixing furnaces, lime and scrap-iron, and refined by gas produced in the gas furnace; the product is cast into desired shapes. At the crucible furnaces, a special steel which is used in the manufacture of arms, machine tools, etc., is produced.

Yawata Steel Works: Workmen's Dormitory

The steel ingots are transferred to another mill, where they are rolled and cut into preferred sizes, and then

delivered to the other shape making mills. The rolling machines used are of two and three roll types, made of cast-steel, and tempered steel, and they are operated by both steam and electricity.

The rail rolling mill uses the ingots without previous heating. The other mills all heat the ingots before rolling. Steel ingots for the thick plate mill are delivered direct from the furnace to the mill, where the ingots are again heated and rolled. Although the variety of shapes produced is great, the process of manufacture in all the mills is practically the same. The leading products of the mills are heavy and light rails, tees, channels, bars, plates, wire, shaft steel, arms, machine tools.

Business Results

During the first year of its operations the Yawata Steel Works made a profit of Y.229. But in following years it sustained heavy losses regularly, until 1909. In 1910 a profit of Y.52,003 was made, and the next year operations showed a profit of Y.1,546,286. The greatest profit, practically paying the costs of construction to date, was Y.57,727,296, made in 1918. The following table shows the income, expenditure and profit of the Yawata Steel Works for the years 1918-1920 :—

Year	Income Yen	Expenditure Yen	Profit Yen
1918.. ..	107,781,793	56,406,511	57,727,296
1919.. ..	85,733,924	76,533,789	5,094,823
1920.. ..	56,699,684	82,080,723	Loss 25,381,039

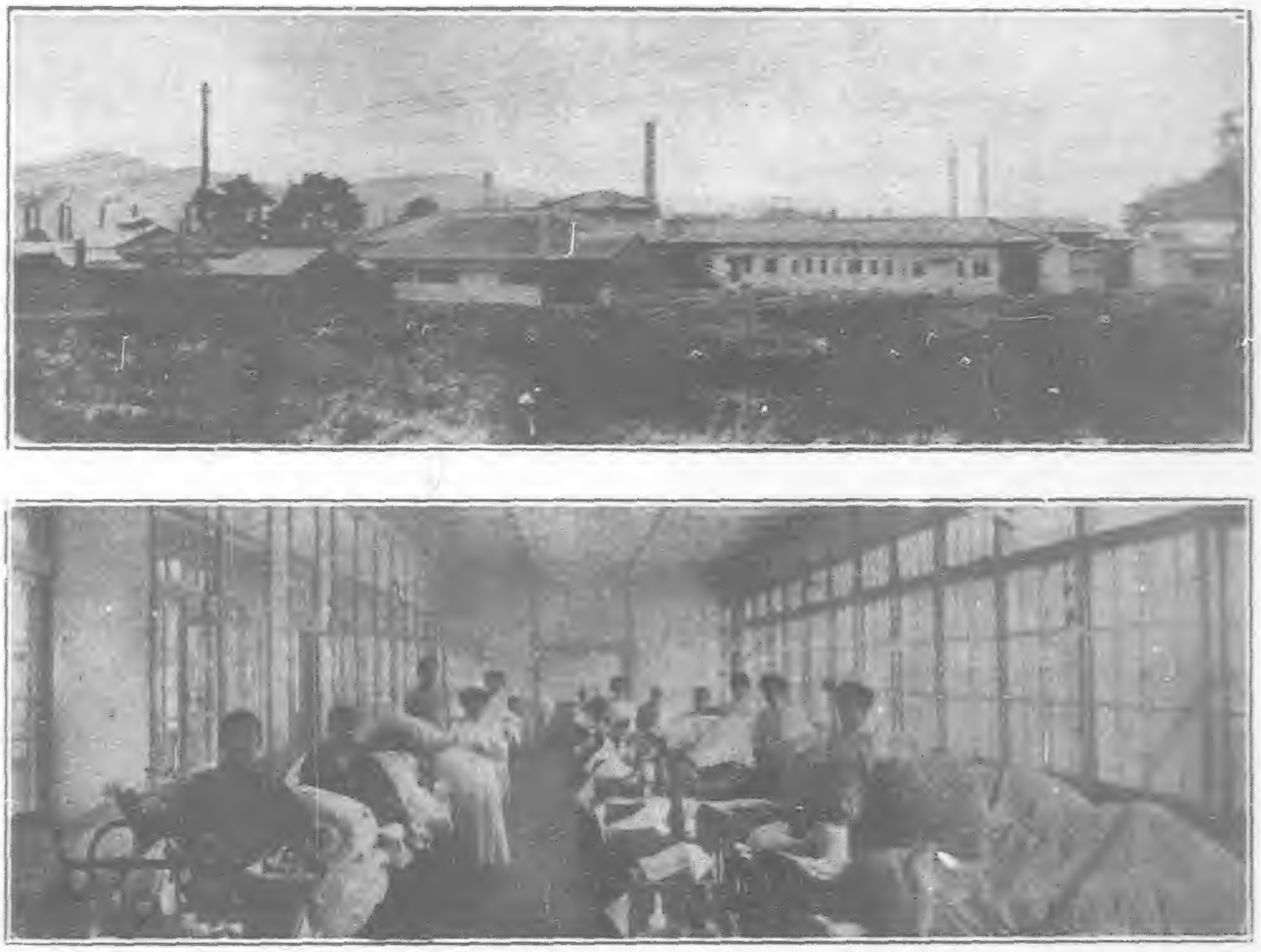
Output of Iron and Steel

During the first year of operation the Yawata Works produced 876 tons of pig iron. Steel was manufactured in 1901 for the first time, and production amounted to 4,956 tons. In the same year 30,041 tons of pig iron were produced. The record production of pig iron was made in 1916, when it reached 302,058 tons. The largest output of steel was made in 1917, when it was 351,738 tons. Since the works were opened to business in 1901, something like 3,061,232 tons of pig iron and 3,330,742 tons of steels have been manufactured (up to 1920). For the five years ended 1920, the production of pig iron and steel is given in the following table :—

Year	Pig Iron	Steel
1916	302,058 tons	276,944 tons
1917	298,836 ,,	351,738 ,,
1918	269,185 ,,	313,550 ,,
1919	267,265 ,,	287,253 ,,
1920	243,571 ,,	297,369 ,,

PRODUCTION OF MANUFACTURED ARTICLES

	1918 Ton	1919 Ton	1920 Ton
Steel plate	78,086	66,099	76,622
Galvanized sheets	2,558	1,472	1,780
Steel bars	63,103	67,051	75,234
Heavy rails	55,105	38,105	56,830
Light rails	52,449	53,299	36,616
Rails accessories and rivets ..	8,602	6,460	5,652
Wheel rims	4,507	4,573	5,003
Wheel axles	1,256	2,203	2,137
Steel ingots and slabs	10,258	20,639	8,638
Tempered materials	293	343	179
Electric furnace steel	553	249	309
Others	7,836	7,332	7,014



Yawata Steel Works: Hospital, Exterior and Interior

In recent years the proportion of the manufactures of the works which have been purchased by government departments has been on the increase until in the last year for which figures are obtainable, 1920, they were more than half of the total output. The following table shows the quantity and value of the sales to private and official works :—

DISPOSITION OF OUTPUT

Quantity

	1918 Ton	1919 Ton	1920 Ton
Officially ..	133,262	137,644	160,781
At the Works ..	24,608	18,344	15,475
Private (public) .	152,497	112,248	117,636
Total ..	310,367	268,236	293,892

Value

	1918 Yen	1919 Yen	1920 Yen
Officially ..	36,690,499	37,276,991	38,117,451
At the Works ..	2,808,982	2,641,926	3,214,167
Private	66,696,732	26,466,873	86,206,403
Total ..	108,196,213	66,385,790	127,538,021

Naturally, the value of sales to private persons is much greater than that to official departments to whom only a small profit charge over and above the cost of production, is made.

Property owned by, and equipment of, the Yawata Steel Works:

Total Area of Works: 1,717,262 *tsubo* (*tsubo* = 36 sq. ft.); inside yards, 575,516 *tsubo*; outside yards, 1,143,747 *tsubo*.

Mines Owned.—Iron Mines: Niigata prefecture, Akaishi Iron Mine, and Kurigatake Iron Mine. In Chosen, Kokaido. Inritsu, and Sainei Iron Mines. Collieries: Fukuoka prefecture, Futase Coal Mine; Nagasaki prefecture; Shikamachi Coal Mines. Silica Mines: Ehime prefecture; Yokobayashi Mura, Fukuoka prefecture, Matsugawa Mura. Lime Deposits: Fukucka prefecture; Matsugae Mura, Oita prefecture; Tsugumi Mura and Aoe Mura. Zechstein Mines: Kwantung Districts, Shusuiton, etc.; Fukuoka prefecture, Katsugae Mura; Oita prefecture, Tsugumi Mura.

The coal mined is used as raw material for the coke furnace for making gas, and for heating ingots, and ordinary heating pur-

poses. Because the quality of the coal mined in the mines owned by the Works is somewhat poor, being high in sulphur and phosphorous content, the coal from the three mines is mixed for the coke furnace. There are five pits in the Futase Mine, and it produces about 750,000 tons a year. Of this total, 380,000 tons are used for coke, the balance for direct fuel. The Shikamatsu coal mine was opened in April, 1920, and production that year amounted to only 43,682 tons.

Water Supply.—The Works own five reservoirs, with a total capacity of 364,000 cubic metres. Another is now under construction, and another planned. The capacity of these two will be more than 8,300,000 cubic metres.

Power.—The Yawata Main Works: Potential horse power, 103,725 h.p.

Details of Power Plant.—Steam Plant: 247 boilers, 71 steam generators, with a total of 98,455 h.p., of which 57,395 is used direct for motive power, 4,830 in hydraulic work and 36,320 h.p. for producing electric power.

Gas Plant.—Uses exhaust of the blast furnaces: 3 gas generators, with a total potential power of 5,270 h.p.; 1 generator is used for supplying air to furnaces, 810 h.p.; 2 generators are used for producing electric power, 4,460 h.p.

Electric Plant.—Supplies 1,630 electric motors, using 63,562 h.p. electric furnaces; 5, using 1,940 k.v.a.; electric lights, 23,795, converted into 10 candle power, some 138,000 lights. Besides this some 700 k.w. are purchased from outside.

Futase Branch Works.—Steam Plant: total h.p. 11,753; used for transportation, 4,156 h.p.; generating electricity, 7,540 h.p.; other uses, 57 h.p. Generator: 5,131 kilowatts. Electric generator, total h.p. 12,062 h.p. Details: For transportation, 3,131 h.p.; for ventilation, 1,547 h.p.; for pumping, 5,525 h.p.; coal grading, 370 h.p.; other uses, 1,489 h.p.

Transportation Equipment.—Main Works: *Docks*: 1,759 *ken* (*ken* = 6-ft.). Of this total, 462 *ken* have a depth of 20-ft., so that vessels of 3,000 tons can be moored. *Basin*: 3 places with total area of 20,423 *tsubo*.

Steamers Owned.—4 vessels, *Keizan Maru, Chirin Maru, Konan Maru, Shiokubi Maru.* Total tonnage 29,723 tons.

Small Vessels.—14, total tonnage 569, in addition to 8 barges. Factory railways, 82 miles; steam locomotives, 102; electric locomotives, 9; steam cranes, 38; freight cars, 1,602.

Factories

Name of Building.	Present Equipment	Equipment when expansion planned is completed.
Blast furnaces	5	6
Other furnaces ..	13	13
Gas refining apparatus	3	3
Gas tanks	2	2
Air drying apparatus ..	1	1
Pig iron casting equipment	1	2
Cooling towers	4	4
Casting mill	2	2
Coal washing plant ..	3	3
Coke furnaces	1	2
Sulphite mill	1	1
Ammonium sulphate mill	2	2
Benzine factory ..	1	1
Boilers	210	339
Power Plants:		
Kawachi Power Plant	1	1
No. 1 ,, ,,	1	1
No. 2 ,, ,,	1	1
No. 3 ,, ,,	1	1
Laboratories	2	2
Lime factory	1	1
Fire proof brick factory	1	1

Factories

Name of Building.	Present Equipment	Equipment when expansion planned is completed.
High furnace, cement factory	1	1
Ore storehouses ..	2	2
Air supply room ..	1	1
Solution mixing mill ..	1	1
Dolomite factory ..	2	3
Pumping rooms ..	7	7
Rotary furnace mill ..	1	1
Horizontal furnace mill	2	3
Crucible steel mill ..	1	1
Electric furnace mill ..	1	1
Steel ingot mill ..	3	6
Rail mill	1	1
Large shape mills ..	2	3
Moulding mill	1	1
Medium size shape mill	2	2
Small size shape mill..	3	3
Wire mill	1	1
Steel sheet mill ..	—	1
Thick plate mill ..	2	2
Medium plate mill ..	—	1
Tin plate mill	1	1
Flat bar mill	1	1
Compressor house ..	1	1
Tempering mill.. ..	1	1
Wheel rim mill ..	1	1
Bolt mill	1	1
Zinc refining mill ..	1	1
Iron alloy mill	1	1
Coal storage plants ..	2	2
Coal tar storage tank ..	1	1
By-products storage tanks	5	5
Transformer stations ..	7	7
Tempering mill.. ..	1	1
Can making mill ..	2	2
Wood working mill ..	1	1
Repair works	2	2
Testing plant	1	1
Warehouses for manufactures	10	10
Warehouses for miscellaneous goods ..	28	28
Round houses ..	4	4
Sea-shore cranes ..	36	36
Sea water tanks ..	1	1

The manufacturing capacity of the different plants belonging to the steel works is given in the following table :—

Pig Iron.	Present.	After expansion
Blast furnace	5	6
Manufacturing capacity ..	400,000 tons	500,000 tons
Steel Ingots :		
Horizontal furnaces.. ..	24	33
Rotary furnaces	2	2
Crucible furnaces	7	7
Electric furnaces	1	1
Manufacturing capacity ..	525,000 tons	750,000 tons

Rolling capacity after expansion works are completed :

Rails	90,000 tons
Bars, steel shapes, large	330,000 ,,
medium ..	96,000 ,,
small	139,600 ,,
Steel plates, thick	150,000 ,,
medium	40,000 ,,
thin, and hyndulate ..	47,500 ,,
flat bars	37,000 ,,

(*Continued on page 204*).

The Bangkok Water Supply

Description of the Works for Supplying the Siamese Capital with Potable Water

By Fernand Didier, Ing. E.C.P., M.S.I.C., France, Chief Engineer of the Bangkok Waterworks

OLD PREVAILING CONDITIONS.—The works for the supply of Bangkok with potable water were solemnly inaugurated, by His Majesty Rama VI on the 14th of November, 1914, and the service was commenced from that date.

Before that memorable event, the population of Bangkok, numbering about 330,000 inhabitants* had only very poor resources in water supply.

Rain water collected from the roofs was used during the west season, and stored by those who had the means to do it.

When rain water was no longer available, water had to be taken from the river, from the numerous klongs (canals) intersecting the town, and from the ponds and ditches excavated around the habitations. Only those who have seen the old Bangkok klongs can imagine to what extent this water was polluted.

An old company pumping the water from the most polluted part of the river in the Chinese quarter, distributed this water without any treatment, by intermittent service, to the few quarters of the southern part of the town where klong water was not easily obtainable.

Among the middle classes of the population, the water was clarified, if not purified, by treating it with alum in earthenware jars by the old process in use in ancient Egypt.

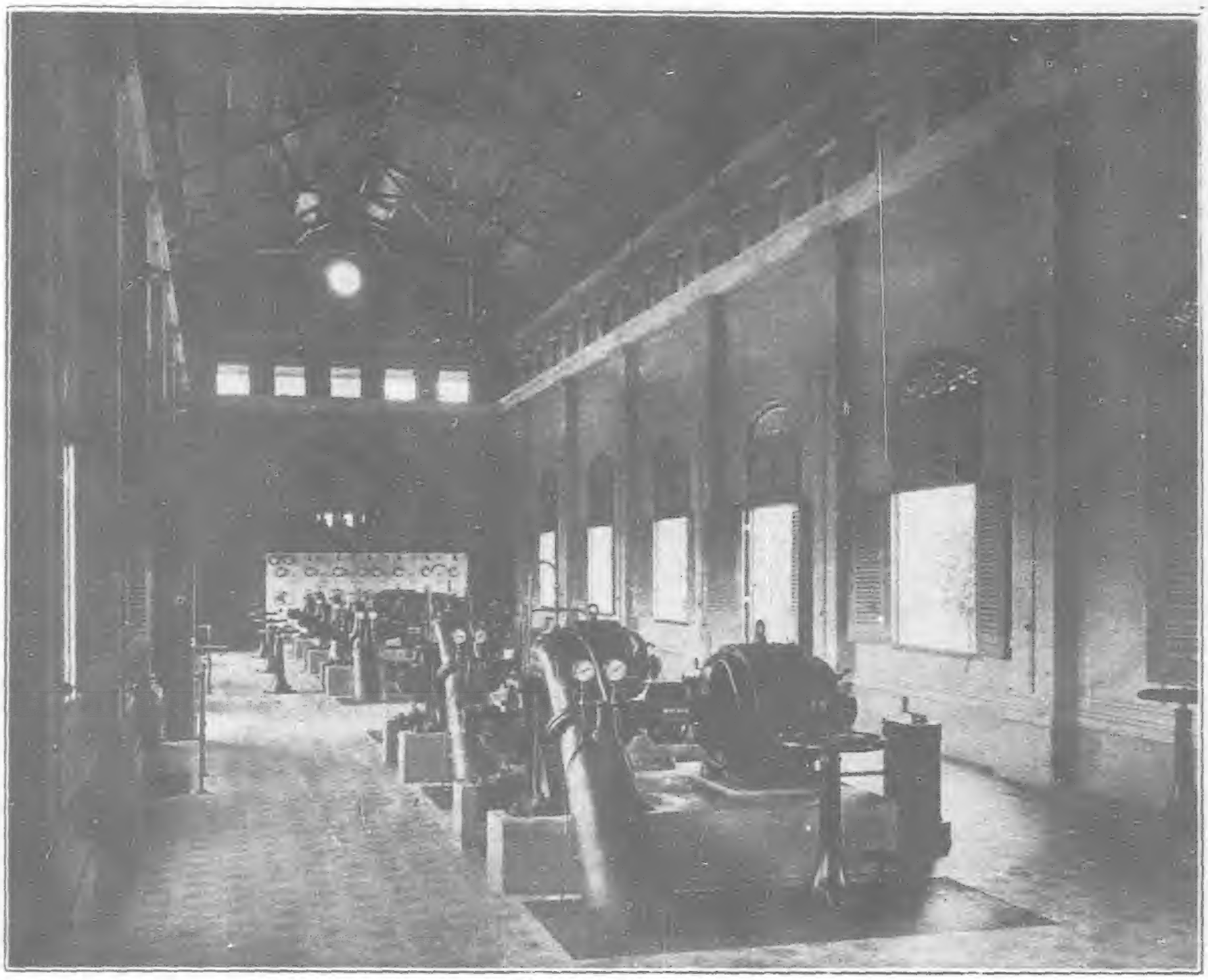
A few artesian wells bored during the preceding ten years supplied a comparatively pure water to a few fortunate establishments, but the amount of water derived from this source was practically negligible as compared with the needs of the population.

The conditions regularly turned to the worse during the dry season when, as is explained later, the water becomes and remains brackish for several months, the pollution from the town being at the same time much aggravated by the ebb current in the river.

As soon as the new supply was started, the street fountains became very popular, and were well patronized.

All classes of the population eagerly availed themselves of this commodity, quite new to Bangkok, which contributed so much to the improvement of the conditions of life in the Siamese capital.

SOURCE OF SUPPLY.—No other source of supply being available, the only alternative was to take the water from the River Menam Chao Phya at a suitable place, and to have it conveyed to Bangkok and treated by the most approved process before being distributed.



Pumping Station

The Menam Chao Phya is fed by four large tributary streams.

For a distance of about 200 kilometres, this river passes through a low-lying alluvial plain, and is tidal on about half this part.

Towards the end of the rainy season, it overflows its banks over the greater portion of this alluvial plain.

Owing to the influence of well marked dry and wet seasons, the condition of the river water varies greatly, not only during the year, but also from one year to another.

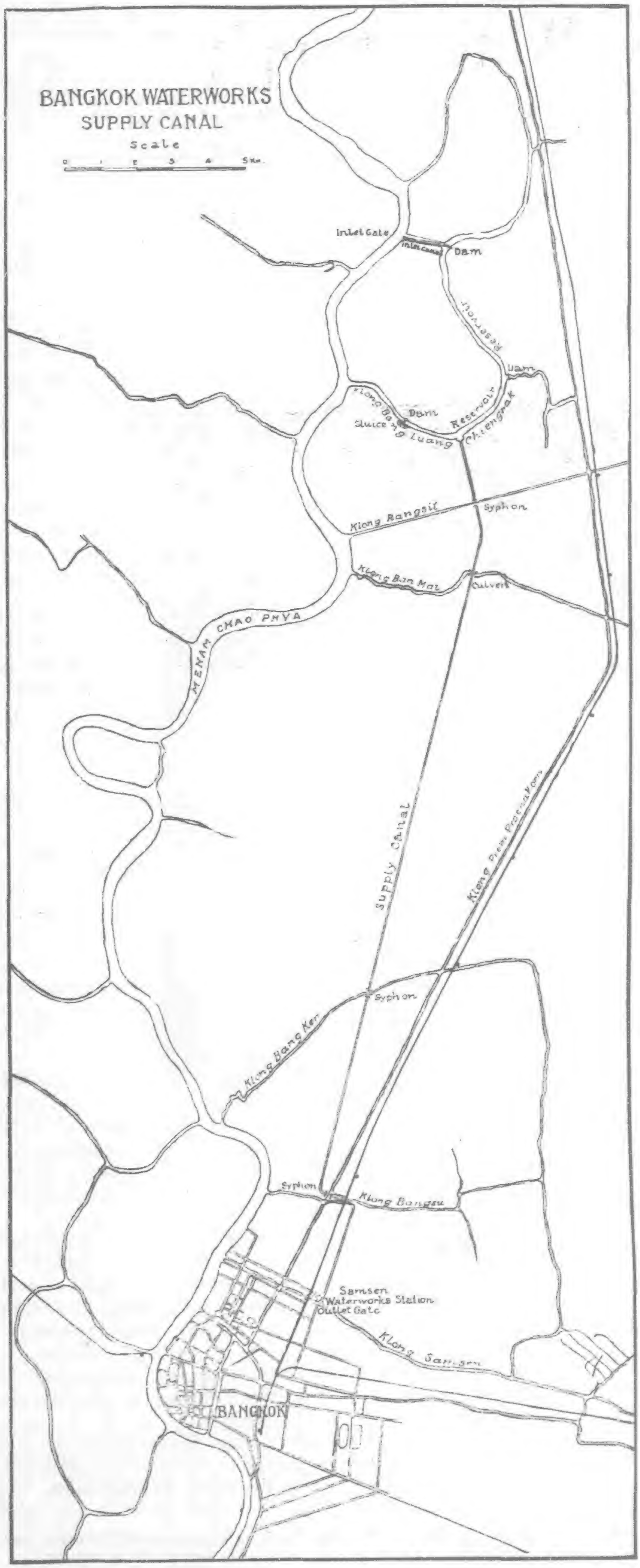
Bangkok is situated on the Menam Chao Phya, chiefly on the east side, about 52 kilometres from the sea following the windings of the river.

Salt is found in the river water at Bangkok, in quantities exceeding the usual limit during about two months and a half, from March to May, in normal years, and during five or even six months from January to June, in exceptionally dry years. Quantities exceeding 2 grammes sodium chloride per litre are quite usual, exceptionally rising to 4 grammes.

The brackish water in ordinary years goes up the river 24 kilometres above Bangkok, and even 30 kilometres in very exceptional years.

The intake gates situated at War Samle, 41 kilometres above the royal palace and far from any agglomeration are therefore safely out of reach by either the brackish or the highly polluted water.

*The population on the east bank is approximately 280,000, and about 50,000 inhabitants are spread over a large area on the west bank.



SUPPLY CANAL.—The Klong Bang Luang Chiengrak, an old branch of the river, has been converted into a large reservoir throughout a great part of its length, by erecting two earth dams across its bed.

An intake sluice with three gates 4 metres wide, opening and closing automatically, has been provided at the mouth of an intake canal 1,200 metres long, 18 metres wide on the surface, 4 metres deep, for the filling of the reservoir at high tide.

A diverting canal round the south dam, provided with a navigation sluice allows the access of boats and eventually of dredgers into the reservoir.

This reservoir has a length of 8 kilometres, widths varying between 60 and 100 metres and depths from 2 to 6 metres. Its normal capacity, which depends upon the possible variation in the water level, is approximately 200,000 cubic metres.

From Klong Bang Luang Chiengrak, the water is conveyed by means of a supply canal 26 kilometres long, 13 metres wide on the surface, and about 3 metres deep, to the waterworks station on the north-east boundary of Bangkok.

Two automatic gates, 4 metres wide, opening themselves at low tide, provide an outlet to the river, through Klong Samsen which has been deeply dredged accordingly. The closing of these gates at high tide prevents the river water from entering the supply canal.

The lower part of this canal is thus emptied during low tide to a very low level, and at the same time thoroughly flushed.

The filling of this emptied section during the closing of the gates at high tide contributes to maintain an efficient and fairly constant velocity in the upstream part of the canal which is fed continuously from the high level water in the reservoir.

The water in the whole system is thus kept in good condition, and no silting up of the supply canal has yet been noticed.

Great precautions have been taken to protect this supply canal against pollution, in order to take full advantage of the natural purification of the water flowing for 26 kilometres exposed to the action of the air and the sun.

Two earth embankments running along the banks prevent any flow of water from the adjoining fields or gardens.

As it was necessary to interfere as little as possible with the irrigation, drainage and navigation through the existing klongs crossed by the supply canal, three reinforced concrete syphons have been built under the waterways of Klong Rangsit, Klong Bangsue and Klong Prem.

A reinforced concrete culvert has also been laid under the supply canal at Klong Ban Mai for irrigation and drainage purposes.

Seventeen bridges have been erected, giving full facilities for crossing the canal.

A royal decree forbids, with proper penal sanctions, navigation, fishing, bathing, washing and any action which would cause a pollution of the water.

Seven stations for the canal-keepers and coolies are erected at the main works along the whole system.

The canal-keepers are under a responsible chief inspector stationed at Chiengrak with four gendarmes at his disposal.

The organization is completed by a telephone line connected with the waterworks central office.

Owing to these precautions, the water reaches the waterworks station in a much less polluted condition than at the intake.

An emergency reinforced concrete pipe 1.10 m. in diameter could be used to take water temporarily from the river at Samsen, during the high water season, for the few days

which would be required for diverting the supply canal in case of the syphons needing repairs.

A flushing tank is provided for the thorough flushing of this pipe before use.

Pumping Plant.—Electric power is supplied by a government power station established for centralizing the production in view of lowering its cost.

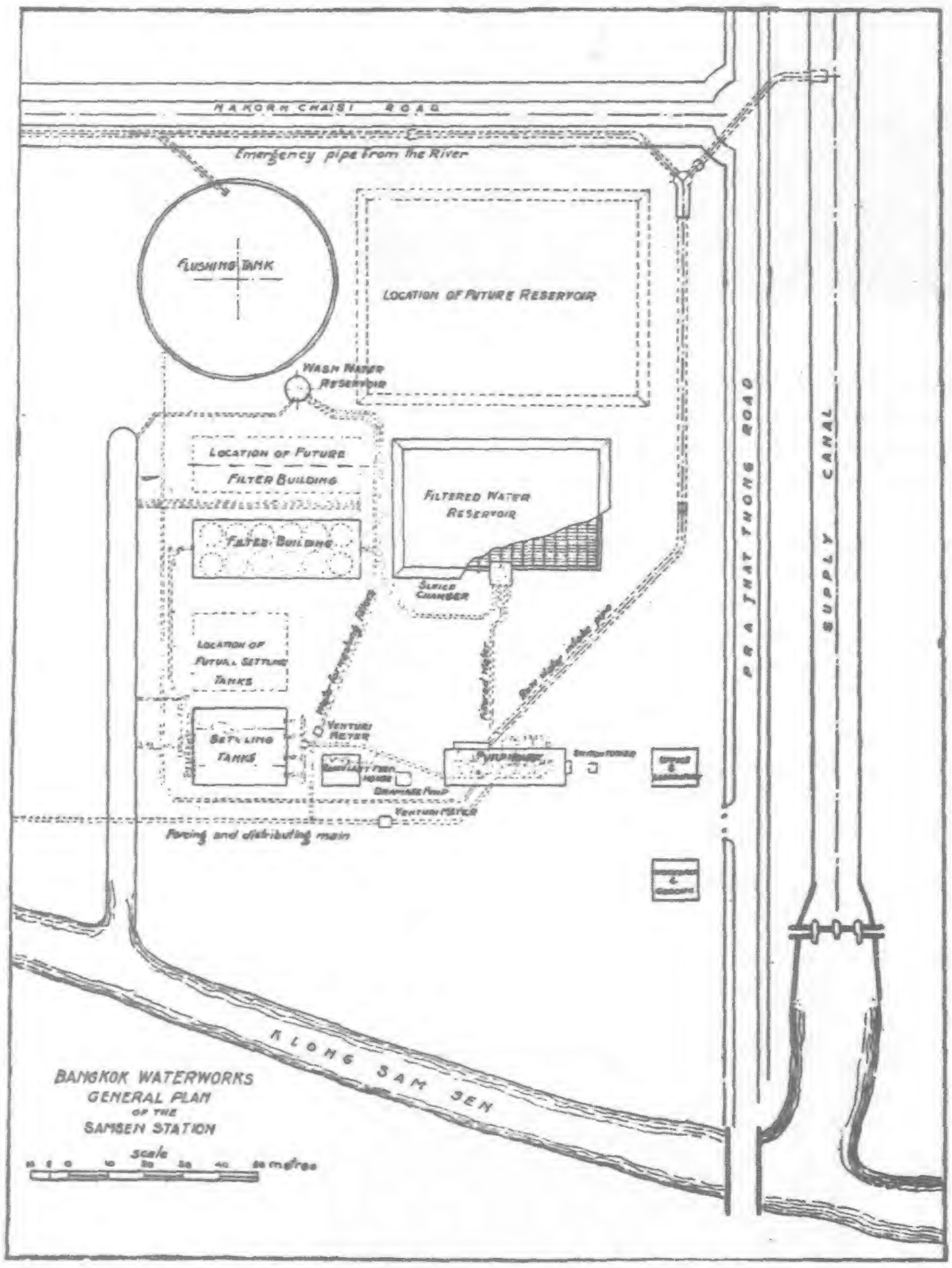
Power being available in that form, centrifugal pumps were adopted, as a matter of course, driven by asynchrone motors fed with the primary three-phase 50 periods 3,500 volts current without transformation.

A transformer reduces the tension to 100 volts for the small auxiliary motors and the light.

The raw water is pumped from the canal to the settling tanks by two low-lift centrifugal pumps, each having a capacity of 320 litres per second against a total head of 9 metres, driven by 60 h.p. motors at a speed of 720 revolutions per minute. One pump is normally in use while the other is in reserve.

The filtered water is pumped from a low storage reservoir and forced in the distributing main by three high-lift centrifugal pumps, each having a capacity of 250 litres against a head of 30 metres, driven by 160 h.p. motors at a speed of 960 revolutions per minute.

The total capacity of the plant is 26,000 cubic metres per day, with two pumps working during the day, one pump only working during the night, the third unit being in reserve.



A small air pump 200 m.m. in diameter 200 m.m. stroke driven by belt by a 3½ h.p. motor is provided for priming the pumps when necessary.

Room is provided for the addition of two more pumping units.

The pump house is 33 metres long and 8 metres wide, inside measurements. All electric cables and water pipes are located beneath the floor.

The electric switchboard is situated at one end. A cabinet at the other end contains a complete set of recording or registering instruments, including two Venturi water metres, for the hydraulic control of the whole installation.

Coagulation, Sedimentation and Rapid Filtration.—The turbidity of the raw water is subject to great and sudden variations, the most noticeable increases occurring after the heavy rainfalls at the beginning of the rainy season.

From October to April or May, the turbidity, measured with the scale of the U. S. geological survey, averages 80 to 100, with frequent increases to 150, and the amount of suspended matter ranges from 20 to 80 parts per 1,000,000.

From May or June to September, the turbidity averages 120 to 170, but 250 or 300 are frequent figures, and 400 has been recorded once. The amount of suspended matter during the same season averages 200 to 300 and has exceptionally reached 500 parts per 1,000,000.

In November or December, the turbidity is not in proportion to the amount of suspended matter, owing to the degree of fineness of the latter.

It would not have been possible to filter this water without a preparatory treatment.

The system of treating the water with a coagulant, for a quick sedimentation and a rapid filtration, known as the American system of filtration, has been selected as the most suitable for treating the raw water available.

The coagulant used is sulphate of alumina.

The following reaction takes place :

$$Al_2(SO_4)_3 + 3CaCO_3 + 3H_2O = Al_2(OH)_6 + 3CO_2 + 3CaSO_4$$

In plain words, the acid contained in the sulphate of alumina unites with the alkaline bases of the carbonates of the water thereby liberating the carbonic acid which is absorbed by the water, and setting free the insoluble aluminium hydrate which is precipitated.

This hydrate coagulates into gelatinous particles which aggregate the suspended substances of the raw water, mud, organic matter and also bacteria, and carry them down to the bottom of the settling tanks.

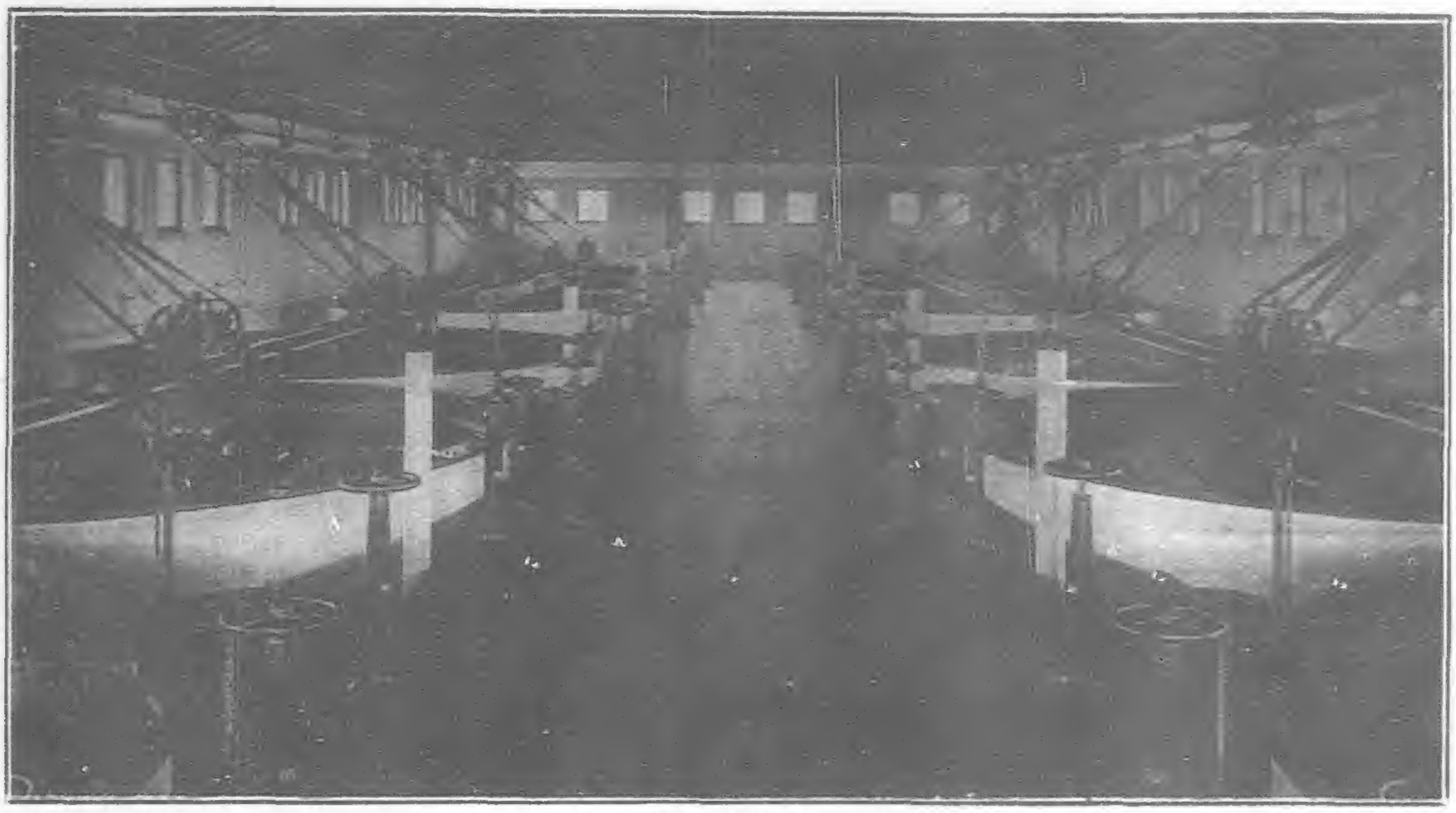
The alkaline carbonates of the water are partially changed into sulphates, the amount of bases being not altered.

The amount of sulphates in the water after treatment remains well within the limit quantities usually admitted in potable waters.

The total hardness of the water is not changed during the process.

The sulphate used is a very pure preparation absolutely free from arsenic.

The amount of carbonates in the raw water is liable to decrease below the required amount for the precipitating of the alumina.



Filter Plant

Such a decrease is very exceptional, and up to the present has occurred during five days only in October 1918, and during 16 days of the present rainy season. At such times this deficiency has been made good by adding exactly the required amount of sodium carbonate of a very pure quality.

These details are given with the purpose of showing that all precautions are taken to prevent even the smallest amount of alumina remaining in the filtered water.

The water after about two hours sedimentation contains only some fine coagulated particles and bacteria which are retained by the sand filter-beds.

The most efficient part of the filter-beds is the thin gelatinous layer formed upon the top of the sand by these particles, which allows a rate of filtration of 120 metres in 24 hours, or 40 times the usual rate in the slow sand filters treating uncoagulated water, with an equally high efficiency.

This very high rate fully justifies the term of " Rapid filtration " applied to this system.

DESCRIPTION OF THE PLANT.—We shall now see how the above described operation are carried out in practice.

A weak solution of sulphate of alumina made in wooden tubs on the third floor of the coagulant house is distributed through regulating cocks fed from a constant level gravity box, at the uniform rate of one litre solution per minute for each working filter. A lead pipe conveys the solution by gravity into the raw water forcing main.

A very good mixing of the coagulant with the water is ensured by the flow of the latter in this main up to the settling tanks.

The quantity of coagulant used per cubic metre of water ranges from 24 to 34 grammes of sulphate containing 18 per cent. Al_2O_3, according to the condition of the raw water.

The settling tanks, built in reinforced concrete, are divided into four sections, each having a capacity of 760 cubic metres. Each section is provided with five baffle partitions. Two sections are kept in use during ten days, after which they are replaced by the two others and cleaned.

The water flows from these tanks to the filters by gravity.

There are twelve circular steel filters of the Jewell gravity low type.

The filter-bed, 5.18 m. in diameter is composed of a fine sand bed 1 metre thick, resting on a thin layer of gravel.

The collecting system embedded in this gravel consists of drain pipes provided with small brass strainers.

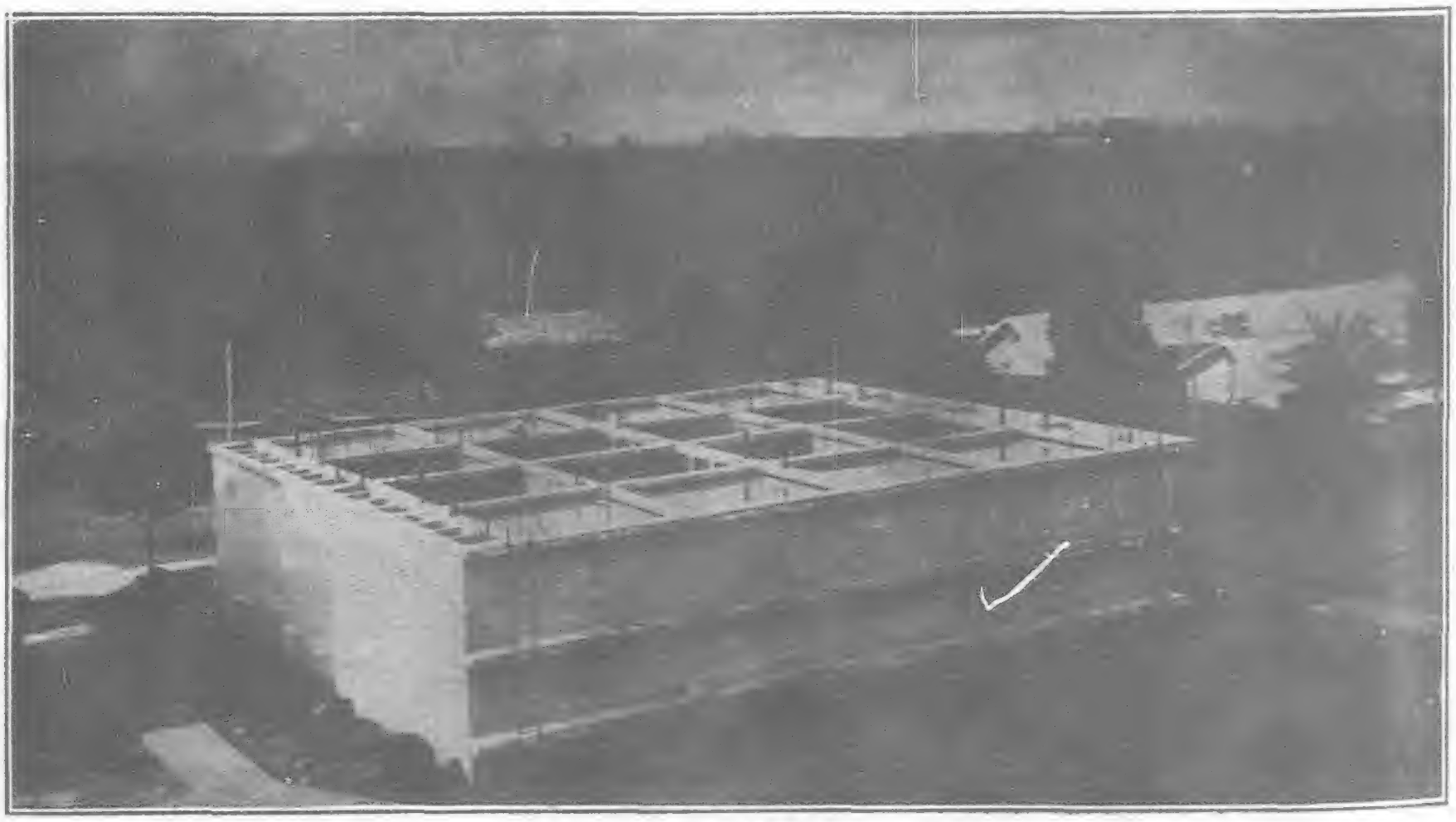
The water flows through the inlet into an annular space around the filter. An automatic inlet regulator maintains a constant level over the sand bed.

An automatic controller, of the Weston type, regulates the rate of filtration and maintains it perfectly uniform whatever be the condition of the filter-bed.

The loss of head through the filter varies from 0.80 to 3 metres approximately. A wash indicator shows this loss of head, and the point of washing the filter. In case of this point being accidentally passed, the Weston controller closes the outlet automatically and stops the filter.

The washing of a filter is carried out by forcing filtered water from a special reservoir through the collecting system and the filter-bed, while the sand is thoroughly stirred to its entire depth by agitators electrically driven. The water is evacuated through the inlet annular space. This operation takes about 6 or 7 minutes with a water consumption of about 60 cubic metres.

The filter is then put in " rewash," or in plain words the first filtered water is wasted for a period of 30 minutes. This rewash allows the formation of the gelatinous film with an ample margin



Settling Tanks

of security, the usual time required for this being about 10 minutes. Then the filter is put again into normal working.

A filter works from 15 to 60 hours according to the condition of the raw water.

The twelve filters, including all the mains, valves, indicators, the 15 h.p. electric motor and shafting for driving the agitators, etc., are sheltered in a spacious building 44 metres long by 16 metres wide, inside dimensions.

From the Weston controller's outlet, the filtered water falls into a masonry flume and goes by gravity to the low filtered water reservoir. This fall contributes to a certain extent to the aeration of the water.

The low filtered water reservoir, measuring 54 metres by 36 metres with a total capacity of 5,700 cubic metres is entirely built of reinforced concrete, and is covered with a thick layer of earth. It is divided into two sections for cleaning, and all its ventilation openings are lined with wire gauze ensuring a perfect protection against mosquitos, flies, insects, lizards, etc. The overflow drain is, for the same purpose, water sealed.

From this reservoir the water is pumped into the distribution system.

The efficiency of the plant is closely checked by daily observations of the turbidity of both the raw and the settled water, and of the color of the filtered water.

The figure found for the turbidity of the settled water shows at once if the amount of coagulant used is correct.

The alkalinity is measured twice a day when a deficiency is noticed.

Bacteriological examinations are made daily at the laboratory of the medical officer of health, and the chemical analyses are carried out monthly at the laboratory of the ministry of commerce.

Elevated Reservoirs

ADVANTAGES OF THE RAPID FILTRATION OVER SLOW SAND FILTRATION.—After this description, it is well worth pointing out the advantages of this system and the reasons which have lead to its adoption.

1. The preliminary treatment of the water by a coagulant is quite simple and the two hour sedimentation is carried on in settling tanks which can be very easily cleaned. Without coagulation, the removal of suspended matters is a most difficult problem requiring the passing through several stages of roughing filters with shallow beds of various grades of gravel and coarse sand filters before the final filtration. The cleaning of these various roughing filters is a most difficult and expensive operation.
2. The rapid filters take a considerably smaller area than slow sand filters, forty times less, not counting the roughing filters required with slow sand filters. Their first cost is therefore much smaller.
3. The rapid filters are well sheltered, and consequently protected from the sun from the wind or rain storms which are causes of evaporation or disturbance of the filtering film.
4. The rapid filters require a smaller staff and are operated from outside, without any risk of pollution.
5. The time for cleaning rapid filters is indicated mechanically without any doubt, and there is no necessity of waiting the results of bacteriological examinations.
6. The system is easily adaptable to the variations in the character of the water, by varying the amount of coagulant used.

Summing up, the rapid filtration system has an indisputable superiority over slow sand filtration which is still more marked in the treatment of turbid waters subject to great variations in character.

DISTRIBUTION SYSTEM.—The filtered water is forced by the high lift pumps into a distributing main 700 m.m. in diameter and about 4 kilometres long which is connected to the bottom of the elevated reservoirs near the centre of the distribution system.

These reservoirs, two in number, have each a capacity of 1,000 cubic metres, with overflow 24 metres above ground. They are built entirely in reinforced concrete, covered and provided with ventilation openings lined with wire gauze.

The offices, workshops, godowns, laboratory for testing metres, etc., are located on the same site.

The distribution system, spread over a large area, includes 95 kilometres of cast iron mains from 700 to 80 m.m. diameter.

The rubber ring joints, adopted on account of the soft nature of the ground and of the unavoidable presence of surface water in the trenches, have saved greatly in the cost of laying, and have proved very efficient in numerous cases of sinking of the mains.

A very wise policy has been adopted for the distribution of the water to the poorest classes of the population, in the erection of not less than 390 public street fountains. 235 of these fountains are fitted with a 100 m.m. fire hydrant enclosed in the body.

These hydrants have on numerous occasions played an important part in controlling fires at the outbreak.

The water is sold through metered services at the reasonable price of 25 satangs or about 6d. per cubic metre. Decreasing rates are applied to large consumptions.

The development of the metered services has been greatly handicapped not only by the scarcity of and the high prices paid for material during the war, but chiefly by the facilities given to draw free water at the street fountains. Nevertheless, the number of customers has recently reached 3,000. All wharves are equipped with hydrants for supplying water to shipping.

Extensions to the distribution system are carried every year, and a scheme is under consideration for the distribution of water on the west bank. The naval establishments are already supplied through a 100 m.m. syphon laid across the river. The want of proper roads in these quarters has been the cause of the delay in carrying out a general scheme.

The daily consumption is in constant progression. It varies from 10,000 to 13,000 cubic metres, the highest figure being reached during the dry season, when people from outer districts come in

great numbers with their boats laden full of jars, drawing water day and night from the fountains standing near the waterways.

The highest consumption corresponds to about 47 litres per head and per day. This low figure shows that there are still good prospects for the development of the sale of water.

The present daily capacity, as explained, is 26,000 cubic metres, and everything has been foreseen for an easy duplicating of the plant, providing an ample margin for the future.

QUALITY OF THE WATER DISTRIBUTED.—The results attained in the purification of the water are well summarized in a yearly report issued at the end of November 1921 by the medical officer of health which is reproduced hereafter :

Bacteriological Analysis.—This is done daily. The water has always been well within the margin of safety as laid down by all competent authorities both in respect to the actual bacterial content and the number of c.c. which must be examined before intestinal organising are found. The former figure has usually been in the neighborhood of 12 *which is very low and invariably well below that of* 100 *which is permissible. The latter figure has seldom been below* 20 *and frequently been* 30 *and over which is two or three times better than the figure* 10 *which is in this case permissible.*

The efficiency percentage which is not so important a matter as the two factors already referred to has usually been 98 *per cent. (a high standard) and seldom less than* 96 *per cent.*

Chemical Analysis.—This is done monthly. Not only has there never once been any chemical evidence of harmful pollution but on the contrary every analysis shows a high state of purification. The water has always been a soft water.

These two analyses have been systematically carried out on all the waters commencing at the raw water as it enters the filter station and ending at the various taps throughout the city.

Conclusion.—This inspection shows that not only is the filter plant doing its work very efficiently but that water supplied to Bangkok is an excellent potable, washing and commercial water and compares most favorably with that supplied to most of the cities throughout the world.

This report, confirming as it does the efficiency of the safeguards employed, forms a fitting conclusion to the description of the methods in use in the Bangkok Waterworks.

This somewhat detailed description has been prepared with the hope that it may contribute to the confidence of the public in the daily use of that great commodity which is now at its disposal, namely, a pure and abundant water supply.

Japanese Ice Combine

The Nitto Ice Manufacturing Co., Ltd.

THE Nitto Ice Manufacturing Co., Ltd., has acquired its principal plants by amalgamations with other companies. It has built very few new plants of its own. As a consequence its fixed property investment is low, and as its policy has been to make large sales at low prices, its business has expanded year after year. The smaller ice manufacturing companies have been obliged to follow its lead, and their operations are now contingent upon those of the Nitto Seihyo.

Owing to the slack organization of most of the ice manufacturing companies in Japan, for many years the banks refused to accept their shares as securities for loans. But with the establishment of the Nitto Seihyo, and its continued prosperity, the banks now accept ice manufacturing shares as tangible securities.

The Nitto Seihyo is a national concern, with branches in Taiwan, Kyushu, in the east and in the north of Japan, as well as many plants in the great centres. It is now operating all over Japan, and is able to regulate supplies according to the demands of different communities. Production is practically the same year after year, and average business results have been unvarying for the past five years.

The most recent development in ice using in Japan has been the steadily growing demand for cold storage plants. It is recognized that the need of cold storage plants in Japan is daily growing more and more acute, as the country's food supplies are more and more being imported from China and Australia, while the fish consumed in the big cities must be transported from the farthest ends of the empire. Ice manufacturers have recently turned their attention to building cold storage plants and the profits earned on them have stimulated competition on all sides. The Nitto Seihyo has recently adopted the policy of equipping all its new plants with cold storage facilities.

The Nitto Seihyo K.K. was formed by the amalgamation of the Nihon Seihyo K.K., and the Toyo Seihyo K.K., in April, 1919, with a capital of Y.9,200,000. Later, other mergers were carried out, and the capital increased to Y.15,251,200, at which figure it stands to-day. The company owns and operates 77 ice plants, located in all parts of Japan.

The total ice manufacturing capacity of all these plants is 2,799.5 tons a day with cold storage capacity of 263 tons a day. Besides these 77 factories the company operates in co-operation with 29 other concerns in the same line of business. These companies produce 503.5 tons of ice a day, and have cold storage capacity for 95 tons. The largest unit produces 165 tons a day, the smallest, 3 tons, but the average plant has a capacity of more than 25 tons a day.

The head office of the Nitto Seihyo K.K. is at 171 Narihira Cho, Nakano Go, Honjo Ku, Tokyo city. The company was originally established in May, 1907, but the present organization was effected in 1919. The officers of the company are : President, E. Wago ; Managing Directors, T. Takagi and Y. Masutani ; Directors, S. Hara, T. Hashimoto, K. Yoshihiro, S. Uru, T. Kume, T. Makita, H. Kato, K. Aoki, S. Sawayama and T. Shigei.

JAPAN IRON AND STEEL INDUSTRY

(*Continued from page 198*)

Wire	50,000 tons
Steel sheets	100,000 ,,
Tempered steel, wheel rims, etc. ..	40,000 ,,

Coke.	Present.	Future.
Coke furnace ..	490 units	590 units
Capacity	500,000 tons	570,000 tons

By-products, after expansion is completed :

Brick	140,000 tons
High furnace cement	18,000 tons

	Present.	Future.
Pitch	14,000 tons	24,000 tons
Tar oil	7,000	10,000
Ammonium sulphate	6,000 tons	9,000 tons
Benzol	3,000 tons	4,200 tons

It has just been announced in the imperial diet that attempts which have been made by interested private concerns to effect a combination with the Imperial Government's Yawata Steel Works, will not have the support of the government at this time. So for some time to come it may be taken that these mills will continue under government management. As the business world becomes more confident the business results of the Works will improve. Since the great war they have been a very paying investment for the government.

Petroleum in Borneo

By Arthur H. Redfield

Concessions.—The concessions range in size from 8,670 to 334,085 acres and most of them have been granted for periods of 75 years, in consideration of an annual royalty of $.201 per cubic meter of petroleum, coal, or other hydrocarbons produced. Usually a minimum yearly royalty is stipulated, ranging from $1,000 to $7,612.

Production.—The production of crude oil in metric tons in Koetei by the Royal Dutch-Shell group, 1910-1920, is illustrated by the following table :—

TABLE II.

	Louise Concession.	Nonny Concession.	Moeara Concession.	Total.
1910	373,086	1,180	32,087	406,670*
1911	495,124	53,396	28,284	576,804
1912	370,278	53,852	26,715	450,845
1913	394,339	69,131	77,595	541,083†
1914	417,410	120,240	74,854	612,504
1915	419,053	164,288	68,150	651,491
1916	461,923	198,199	63,944	724,066
1917	398,841	152,559	65,901	617,301
1918	419,423	169,243	76,815	685,481
1919	— ¶	— ¶	— ¶	770,000‡
1920	— ¶	— ¶	— ¶	744,119§

In addition to the output of the Royal Dutch companies the Nederlandsche Koloniale Maatschappij, a Standard Oil subsidiary, produced 188 metric tons in 1914; 217 tons in 1915; 371 tons in 1916; 139 tons in 1917 and 252 tons in 1918. No figures for later years are available. The production of the Koloniale Maatschappij came almost entirely from its Sadjau concession.

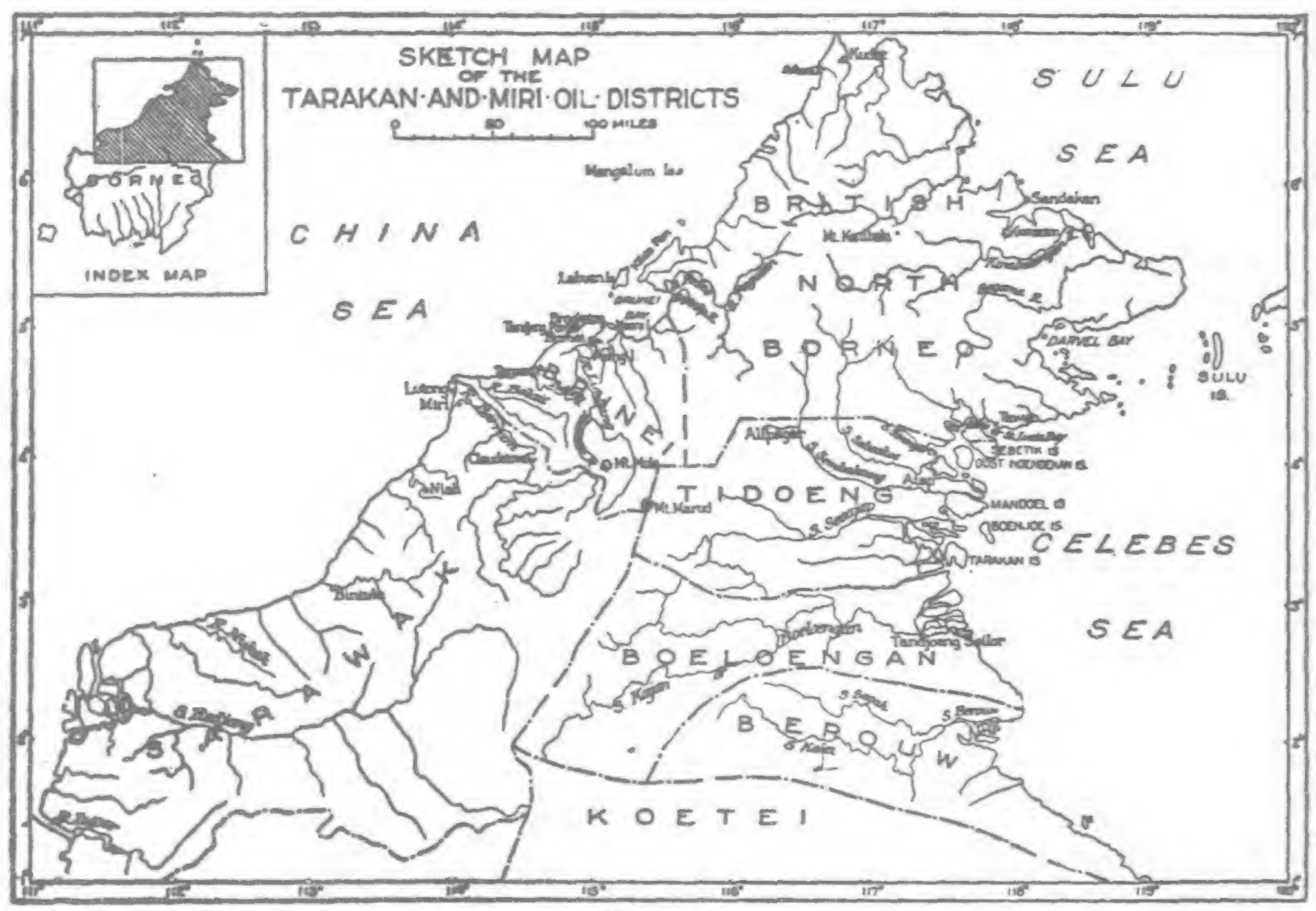


FIG. 36.

Character of Oil.—Three types of oil were won in the Sanga Sanga oil field, from a single structure, such as the Sanga Sanga dome or the Sambodja dome, a heavy asphalt-base petroleum, alight asphalt-base oil, and a "paraffine oil." The specific gravity of the heavy oil ranges between 0.96 and 0.89; that of the light oil between 0.88 and 0.85; and that of the paraffine oil between 0.86 and 0.84. These oils are from definite horizons in the Sanga Sanga beds. In a vertical section taken along the anticlinal axis, the heavy asphaltic oil horizons are found to occur in general at depths of 30 to 150 metres (98 to 490 feet) below sea-level; the light asphaltic oils generally between 240 and 300 metres (between 790 and 1,080 feet) below sea-level; and the light paraffine oil horizons for the most part between 330 and 385 metres (1,080 and 1,260 feet below sea-level, although horizons of this oil have been found as low as 512 metres (1,680 feet) below sea-level. The mouths of the wells occur at altitudes varying from sea-level to 60 metres (196 feet) above sea-level.

The heavy asphalt-base oil has an average specific gravity of 0.9630. The boiling point ranges between 194° and 212° C. The kerosene fraction averages 35.5 per cent., and the lubricating oil fraction 50 per cent. The fraction over 300° C. gives an average of 26.5 per cent. of thick fluid paraffine, indicating an average paraffine percentage of 13.17 in the crude oil. The sulphur content of the crude oil varies between 0.101 and 0.159 per cent.

The specific gravity of the light asphaltic-oil averages 0.8688. This oil has a lower boiling point than the heavy asphaltic oil, varying between 61° and 78° C. The average yield of benzine and light oils is 25 per cent.; of kerosene is 49 per cent.; and of lubricating oils is 20.25 per cent. The sulphur content averages 0.11 per cent. The distillate over 300° C. contains on an average 35.5 per cent. of thick fluid paraffine, indicating an average paraffine content of 7.5 per cent. in the crude petroleum.

The average specific gravity of the light paraffine oil is about 0.8564. Its boiling point ranges between 55° and 84° C. The benzine fraction averages 22.6 per cent.; the kerosene fraction 46.5 per cent.; and the lubricating oil fraction 25 per cent. The distillate over 300° C. contains 40 per cent. of solid paraffine, indicating a paraffine content of 10.1 per cent. in the crude oil. The sulphur content averages 0.07 per cent.

* Includes 317 metric tons produced on the Mathilde Concession.
† Includes 13 metric tons produced on the Toenkoedasing Concession and 10 metric tons produced on the Mintoet Concession.
‡ Estimated.
§ Hoofd van het Mijinwezen, Batavia.
¶ No data.

In Table III. the analyses* typify the three groups of heavy asphaltic oil (I.), light asphaltic oil (II.), and light paraffine oil (III.) from Sanga Sanga.

TABLE III.

	I.		II.		III.	
	%	Spec. Gr.	%	Spec. Gr.	%	Spec. Gr.
Up to 150° C ..	2.4	0.804	17.5	0.815	33.05	0.7957
150° to 300° C ..	33.8	0.896	78.1	0.872	44.05	0.8426
Over 300° C ..	63.8	0.994	4.4	0.980	18.55	Solid distillate
Loss ..	—	—	—	—	4.35	—

The oil-bearing horizons of the Sambodja field have been redivided into four groups of horizons, according to the character of the oil they produce. These oils are named respectively the kerosene-asphalt oil ; the residum-asphalt oil : the asphalt-base kerosene oil ; and the paraffine-base kerosene oil.

TABLE IV.

Analyses of Typical Crude Oils from Sambodja East Borneo.†

	Number of Analysis	Fractions Oo— 150° C. %	150°– 300° C. %	Over 300 %
Kerosene-asphalt oils				
Horizon A1	5	6.5	58.5	35
Horizon A2	1	1.5	43.5	35
Residum-asphalt oils				
Horizons B1 and B2	3	—	23	77
Asphalt-base kerosene oils				
Horizon C1	15	26.5	49	24.5
Horizon C2	5	22.5	53	24.5
Horizon C3	1	26	41.5	32.5
Horizons C4 and C5	4	26.5	54	19.5
Horizons C6 and C7	10	25.5	53.5	21
Paraffine-base-kerosene Oils ..				
Horizons D1 and D2	10	17.5	55	27.5
Horizons D3, D4 and D5 ..	24	20	50	30
Horizon D5	1	16	51	33

Transportation and Refining.—For many years the oil of the Sanga Sanga and Moeara fields was transferred by tank-boats down Mahakkam River by sea to the refinery at Balikpapan. Now a pipe line through the tropical jungle carries the oil directly to Balikpapan. This refinery is said to be the largest in the world, but exact data as to its capacity are not available.

The Tarakan District

Location and Extent.—The Tarakan district lies in the extreme northeast corner of Dutch Borneo, extending across the boundary line into British North Borneo. It includes principally the islands of Tarakan and Sebetik and portions of the immediately adjoining mainland.

Physiography.—From Tandjoeng Seilor to the northwest end of Cowie Bay the coastal region of Boeloengan and Tidoeng consists, save for a few isolated hills, of mangrove swamps. The same is true of the banks of the larger rivers for a considerable distance inland. Inland from the coastal and riparian marshes the country is rolling and hilly.

Areal Geology.—The areal geology of northeastern Dutch Borneo has not been thoroughly worked out. Geologic investigations have been made of the coastal region from Kaniongan (or Mangkalihat) peninsula up to Soengei-Boeloengan (or Kajan). North of Soengei-Boeloengan only reconnaissances have been made of the coastal region, which is 20 to 40 miles wide, and practically nothing is known of the interior.

Quaternary alluvium forms the coastal marshes of Tidoeng in an almost unbroken zone from Tandjoeng Seilor to the British boundary. It also occurs along Sembakoeng River as far as Atap and on the inside bends of the meanders.

Except in the narrow fringes where Quaternary coastal swamp occurs, Upper Tertiary sediments are shown in the larger coastal islands, as Tarakan, Boenjoe, Oost Noenoekan, and Sebetik. The narrow Quaternary, coastal, alluvial deposits are succeeded by a zone, 7 or 8 miles wide, of steep hills which are composed of Upper Tertiary beds.

The Upper Tertiary zone is succeeded to the west by a zone, 5 to 10 miles wide, underlain by the Upper Eocene. A broader zone (15 to 22 miles) of the Lower Eocene occurs to the west. The Sembakoeng beds (Cretaceous?) form a zone 30 to 32 miles wide chiefly in the upper vally of the river of that name. This zone bears generally north-northwest-south-southeast parallel to the upper source of Sembakoeng River. Beds of the lower stage of the Eocene recur, beyond the Sembakoeng beds, near Alipagar.

Stratigraphy.—The oldest sediments observed in Tidoeng are the Sembakoeng beds, which from their petrographic similarity to the Alino and Waringin beds (Middle Cretaceous) and from their stratigraphic position below the Eocene, are considered to be Cretaceous or at least pre-Tertiary. The Sembakoeng beds consist of very hard, silicified, dark-colored shales, alternating in many cases with equally hard silicified sandstone and conglomerate beds. Through the whole formation run bands colored red by *Radiolaria*.

The formations which overlie the Sembakoeng beds conformably have been provisionally referred to the Eocene upon the basis of the presence of nummulites. The lower stage of the supposed Eocene consists of dark-colored clay-marls which alternate with hard sandstones. The clay content of the marls is somewhat low ; this stage apparently forms the transition from the Sembakoeng shales to the upper marls. The upper stage is composed of soft gray-green to gray clay-marls, which are in many cases concretionary, fracturing in nodules. The bedding of the marls can be definitely determined only where the marls alternate with sandstone beds.

The Upper Tertiary of Tidoeng has not been subdivided. It consists principally of light-colored loose or poorly consolidated sands alternating with well-bedded conglomerates, white to light-yellow in color. Thin coal-seams occur here and there through the complex. The bedding is generally indistinct. In many places it can be distinguished only by the occurrence of the conglomerate strata or coal-seams, or by the occurrence of bands of clay or bituminous layers.

Quaternary alluvium overlies the Upper Tertiary beds unconformably.

Geologic Structure.—The coastal region of Tidoeng is in general gently folded. The axes of folding bear generally N. 30° W. The anticlines are represented by the islands, while the synclinal basins are occupied by broad estuaries and sea-straits between the islands and the mainland.

Five anticlines, whose axes trend in a northwestward direction, have been observed in the Tarakan district. The first or Tarakan anticline crosses Tarakan Island from south-east to north-west and may be followed across the British-Dutch frontier. A second anticline, parallel to the first, crosses Boenjoe and Mandoel Islands to the mainland and extends to the international boundary. The Poeloe Oost Noenoekan anticline, crossing the island of that name, and the two anticlines of Poeloe Sebetik, follow the same direction.

These anticlines are separated by corresponding synclines. The first of these is marked by the strait between Tarakan Island and the mainland. The second is occupied by the central mouth of Soengei Sesajap and the strait between the islands of Boenjoe and Tarakan. The third is occupied by the mouth of the Simengaris and the strait between East and West Noenoekan. The fourth is occupied by the strait between Sebetik and Oost Noenokan. The last is filled by Cowie Bay between Sebetik and the mainland near Tawao.

* Analyses by James Kewey, The Crude Oils of Borneo
† Escher.

The principal anticline of the Tarakan district, that of Tarakan Island, consists mainly of two domes, separated by a structural depression. The axis of the anticline bears north and south.

Development.—The British Borneo and Burma Petroleum Syndicate made an unsuccessful attempt to drill at Tawao, British North Borneo, on the mainland opposite Sebetik Island. No details regarding this venture are known.

The Royal Dutch Co., by arrangement with the British Borneo Petroleum Syndicate, drilled a well on Sebetik Island in 1914. In July of that year the well had reached a depth of 1,437 feet and traces of oil were found. The outbreak of the war caused the suspension of operations. As only small shows of oil were met, the well was finally abandoned.

The Bataafsche Petroleum Maatschappij began development of Tarakan Island in 1905. Commercial production began in 1907 with an output of 16,432 metric tons.

Production.—The production of crude petroleum on Tarakan Island is illustrated by Table V.

Character of Oil.—The crude oils of Tarakan are comparatively uniform in character and show little variation with depth. They are all of asphalt base, with a specific gravity ranging from 0.942 to 0.955. They contain no benzine fractions and have a flash-point in the vicinity of 100° C. Their viscosity is low; they are quite liquid at 10° C. They contain only 0.6 per cent. of asphalt insoluble in alcohol ether, and have a coking value of 4 per cent. The sulphur content is 0.3 per cent. They are excellent liquid fuels and are used almost entirely for this purpose. They are also used successfully in Diesel engines and can be distilled for lubricating oils.

TABLE V.

PRODUCTION OF CRUDE PETROLEUM ON TARAKAN ISLAND, 1910-1920, IN METRIC TONS.*

	Tarakan I.	Tarakan II.	Tarakan East.	Tarakan North.	Total.
1910	2,327	224,475	—	—	226,802
1911	2,954	234,925	—	—	237,879
1912	2,613	218,979	—	—	221,592
1913	3,157	221,004	1,318	—	225,479
1914	41,891	206,864	4,965	306	254,026
1915	89,165	147,560	5,418	40	242,183
1916	97,791	132,484	2,684	—	232,954
1917	117,060	133,517	1,245	—	251,822
1918	185,757	146,758	366	812	333,693
1919	— §	— §	— §	— §	600,000†
1920	— §	— §	— §	— §	711,609‡

Wells.—The Tarakan oil fields in 1920 contained about 300 derricks. The wells had an average specific capacity of about 100 metric tons per day by pumping. One well flowed about 500 tons a day; and another of equal capacity had become choked with sand; it was expected, however, to come in again flowing. New wells were being drilled.

Transportation and Refining.—The oil is pumped from the fields to Linkas, the port of embarkation, where there is a storage plant of 15 tanks of 20,000 barrels capacity. Two more of a capacity of 50,000 barrels were under construction in 1920. The tanks are located about 60-ft. above sea-level and the oil is loaded by gravity through two 8-in. pipe lines. It is claimed that a ship may be loaded at the rate of 400 tons per hour.

For refining, the Tarakan oil is shipped in tank steamers to Balikpapan. Much of it, however, is exported directly as fuel oil, no refining being necessary. Exports of fuel oil from the customs district of Tandjoeng Seilor amounted to 101,204 cubic meters (636,573) barrels) in 1913; 154,266 cubic meters (970,335 barrels) in 1914; 183,695 cubic meters (1,155,440 barrels) in 1915; 185,518 cubic meters (1,166,910 barrels) in 1916; 188,890 cubic meters (1,188,157 barrels) in 1917; 172,200 cubic meters (1,083,139 barrels) in 1918; and 529,379 cubic meters (3,329,794 barrels) in 1919.

The British Borneo Oil District

Location and Extent.—This district includes all the possible oil-bearing territory of the British portion of Borneo, except the north end of Sebetik Island and the immediate surroundings of Cowie Bay, which have been discussed under the Tarakan district. The entire zone of folded Tertiary sediments of the British portions of Borneo may be petroliferous, but the present producing district is a relatively small part of the zone. The folded Tertiary zone includes the coastal region of northern Sarawak, the coastal Tertiary zone of Brunei and the coastal region of British North Borneo northwestward to Cape Sampanmangio and southward almost to the Dutch frontier. The only portion, however, of this zone of which the geologic structure is known with any certainty or detail is the comparatively small area which surrounds Brunei Bay.

The Miri oil field is at present the only producing field in the British portion of Borneo. It is situated on the west coast of Borneo in the Rajahship of Sarawak, along the Brunei frontier. Among other possible oil fields are the Belait district of northwestern Brunei, adjacent to the Miri field; the island of Labuan; the Klias Peninsula; and the valley of Sekuati River, in British North Borneo.

Physiography.—British Borneo as a whole may be divided into three physiographic provinces, (1) a central mountain chain, (2) a zone of low hills, and (3) a zone of coastal swamps.

The mountain chain which forms the boundary between British and Dutch Borneo extends from Cape Datu (or Datoe) eastward to about longitude 113° E., thence in a generally northeastward direction to the sea. The mountain chain is quite irregular in elevation, and contains the highest peak in the island of Borneo, Mt. Kinibalu, 13,698-ft. in altitude. The central range varies from 6,000 to 8,000-ft. in elevation, while the ranges which form the boundary between Sarawak and West Borneo are only 2,000 to 3,000-ft. in height. This boundary range extends parallel to the north-west coast of the island at an average distance of 100 miles from the sea.

The hill zone comprises the greater part of British Borneo. It consists of hills averaging 500-ft. in elevation. The coastal swamps of British Borneo, in contrast with those of the Dutch portion of the island, are small in extent and mangrove swamps are largely limited to the coast of Brunei Bay.

Areal Geology.—The mountains which form the boundary between the British and Dutch possessions in Borneo consist of granite, diabase, serpentine, and gneissic rocks, and of hard Paleozoic sandstones, quartzites, slates, and massive blue Carboniferous (?) limestones and extends in a generally southwest-northeast direction. Certain peaks, notably Marud and Kinibalau, are composed of granite. The flanking ranges consist largely of Paleozoic sediments. Paleozoic quartzitic sandstones occur on Kapinaga River within ten miles of Brunei Bay, and along Padas River. Mt. Mulu in Brunei is largely composed of Carboniferous (?) limestone.

The coastal part of the hill region is Tertiary. East of Padas Bay, a small indentation at the northeast corner of Brunei Bay, the Tertiary is only 10 to 15 miles in width. At the town of Brunei it is about forty miles wide; and further southward in the valley of Barram River, in northern Sarawak, it is about 80 miles wide.

A belt of Quaternary alluvium averaging about 60 kilometres (36 miles) in width extends along the coast of southern and central Sarawak, narrowing until it disappears at Brunei Bay.

Stratigraphy.—The Tertiary, which is the oil-bearing system of British Borneo, is composed in general of sandstones, shales, marls, conglomerates, and limestones, with interbedded lignite seams. The majority of observers have correlated these strata with the Lower Tertiary of the south of Borneo and especially

* Jaarboek van het Mijinwezen in Ned. Oost-Indie, Batavia.
† *Financial Times*, London, January 19, 1920.
‡ Hoofd van het Mijinwezen, Batavia.
§ No data.

with Verbeek's "alpha" and "beta" stages of the Eocene. Later Tertiary, however, in all probability occurs.

A limestone formation occurring along Madalam River between the provinces of Brunei and Sarawak has been identified by its fossils as Eocene. The lignite measures of Brunei and Labuan, which consist of alternating beds of clay, sandstone, and conglomerate, with several good lignite seams, are considered by Evans to be Eocene.

The coal measures of Labuan, as exposed at Kubong Bluff at the northern extremity of the island, consist of a base of blue shale probably 150 to 180-ft. thick, which includes extremely thin layers of argillaceous sandstone, and is overlain by alternating sandstones, conglomerates, clays, and coal seams to a total thickness of over 300-ft. The sandstones vary in color from red and blue to white, and in texture from coarse to fine. The conglomerates are composed of quartz, sandstone and coal pebbles, cemented generally by oxide of iron. The clays are generally blue, and in many cases contain nodules of iron oxide. Fireclay underlies the coal seams. The coals are lignitic, containing 6.1 per cent. of hygroscopic water, and include masses of semi-transparent resin.

Coal measures of supposed Eocene age occur along the coast of northern Sarawak, Brunei, and British North Borneo. Some of the best-known occurrences are those of River Linga, a tributary on the left bank of Batang* Lupar; at the junction of Simunjan and Sadong rivers; along Redjang and Mukah rivers; at Muara Island, opposite Brooketon, and Gaya; on Marudu and Sandakan bays; and on Kinabatangan River. On Sekuati River Hatton found a resinous coal similar to that of Labuan Island.

It is uncertain whether all the coal and lignite seams of British Borneo are Eocene. Some indeed may be of later Tertiary age. The succession of Tertiary rocks has not been worked out with the same degree of precision in British Borneo as in Dutch Borneo. Miocene coal-measures are extensive in Dutch Borneo, as well as in Sumatra, and like the coal measures of British Borneo have proved to be petroliferous.

The Oligocene is represented by bluish-gray clays, and by shales and marls. Orbitoid limestones of supposed Miocene age have been found on Madalam River, and on Gomanton Hill near Kinabatangan River in the northeast part of the island. Nummulitic limestones, whitish or bluish in color, occur at the coastward edge of the hill zone of central Sarawak.

The lower Quaternary sediments consist of conglomerates of quartz-pebbles or of pebbles of Tertiary rocks, chiefly sandstones and coral limestone, in places interspersed in a clayey earth, or cemented in other places by a hard siliceous cement. The upper beds are composed of a somewhat sandy clay, which becomes less sandy toward the top.

Late Tertiary volcanic activity is evidenced in the south of British North Borneo by hills of basalt and feldspathic and pyroxene andesites, notably on the north of Cowie Harbor. The extent of the Cowie Harbor volcanic region is unknown, but it may embrace the Darvel Bay region.

Intrusive and extrusive igneous rocks occur locally throughout western Sarawak. The intrusives, particularly quartz-porphyry dikes, have penetrated and disturbed the coal measures of the Bau and Bidi gold district in Upper Sarawak subsequent to the Miocene folding. In central Sarawak igneous rocks, particularly basalts, hornblende-augite-andesites and feldspar porphyries, have also disturbed the coal measures and occur as hills and peaks. These intrusions are accompanied by deposits of tuffs and volcanic agglomerates.

Structure.—The Tertiary of the Brunei Bay region and of nothern Sarawak is strongly folded. The axes of folding bend considerably in their courses but trend in general in a south-southwest to north-northeast direction, parallel to the coast.

Three anticlines have been determined at Brunei. The westernmost of the three a comparatively closed fold, is exposed on the steep cliffs of Tandjong† Puniet. On its eastern flank the beds strike N. 45° W. and dip 30° to 50° to the east; on the western flank the strike is N. 10° E. and the dip 20° to 50° to the west. The remaining two anticlines occur between Asing Island and the town of Brunei. Their axes bear to the northeast, with strata dipping 50° to 80° on both sides. The Eocene (?) coal measures of Brooketon are exposed in both these anticlines.

The characteristic course of these folds is sinuous. The anticline of Tandjong Puniet may be connected with the southern of the two anticlines of Labuan Island. The two anticlines between Asing Island and Brunei reappear on the Klias peninsula. The northward continuation of these two anticlines appears to be interrupted by a normal fault. The three parallel folds on the northern end of Klias peninsula are probably the northeastward continuation, beyond the fault, of the southern folds.

The possibilities of obtaining petroleum in commercial quantities from the Brunei Bay region are, in the judgment of Schmidt, not especially favorable. The anticlines occur with steeply dipping limbs; only the southern anticline of Labuan and the central anticline of the northern Klias Peninsula have a broad crest with flatlying strata. The nearness of the paleozoic central mountain region postulates this strong folding of the strata, and where the Tertiary foreland farther to the south is broader, less close, folds may be expected.

The geologic structure of the Miri field proper is not so well known as that of Brunei Bay. There is, according to Kewley, a well marked anticline, of which the eastern limb is the steeper. The oil is drawn from the western limb.

The Quaternary beds of the coastal plain are generally horizontal or only slightly inclined as at the border of the Tertiary hillland.

Indications of Oil.—Oil seepages, issues of natural gas, and mud volcanoes are situated along the axes of the anticlinal folds, on Klias Peninsula and on Labuan Island. Oil seepages further occur along the anticlinal axes on Brunei Peninsula. A new island, which owed its origin to an eruption of natural gas, appeared off the Klias Peninsula, opposite Labuan Island, on September 21, 1897.

On Labuan Island a thick black oil seeps from a sandstone, 7 metres (23-ft.) thick, which is intercalated in shales. A bore hole drilled 450-ft. into this formation encountered at 391-ft. a high-pressure flow of gas, but no oil. At Kubong Bluff a shaft sunk 20-ft. delivered in 1879 about 12 gallons daily of petroleum of 0.965 specific gravity.

Petroleum seepages have been discovered in British North Borneo on River Sekuati. Not far from the coast the clayey soil of a tidal swamp is saturated with petroleum. A shaft sunk to a depth of 35-ft. revealed beneath 4-ft. of surface clay an oil-bearing ferruginous sandstone inter-bedded with shales. Pieces of coal with resinous inclusions were also found. The petroleum is a thick oil or bitumen, containing a paraffine oil and an oxidizable body belonging to the camphors or turpentine.

The oil of the Miri field occurs in a sandstone formation. The strata are of Miocene age, according to Kewley, and coals, which mark the Miocene elsewhere in Borneo, are absent.

Development.—The Anglo-Saxon Petroleum Co., a Royal Dutch-Shell subsidiary, began drilling in the Miri field of Sarawak in 1911. Several wells came in at a shallow depth, below which a second oil stratum was struck. Commercial production began in 1912. The British-North Borneo and Burma Petroleum Syndicate made unsuccessful attempts at drilling along Kinabatangan River. No details are known about this venture.

An arrangement was made by the British-North Borneo and Burma Syndicate in 1912 with the Nederlandsche Koloniale Petroleum Maatschappij, a Standard Oil subsidiary, under which the Koloniale Mij. was to prospect the entire British-North Borneo concession and develop the Klias Peninsula. A similar arrangement was made in 1914 for the Brunei concessions. Four wells

* *Batang* in Malay means "river."
† *Tandjong* or *tandjoeng* in Malay means "cape."

were sunk by the Nederlandsche Koloniale Petroleum Mij. for the British-Borneo Petroleum Syndicate on Klias Peninsula; small shows of oil and gas were struck in Nos. 1 and 2, but these were abandoned at 1,500 and 1,280-ft. respectively. According to the profile drawn by Schmidt, these wells were located in a close syncline. Well No. 4 struck oil at 2,303-ft. and produced at the rate of 1,200 gallons of light oil a day, but the well was capped. After the conclusion of the agreement with the Nederlandsche Koloniale Petroleum Mij., the D'Arcy Exploration Co., which took over the lease, did not attempt to continue drilling on the Klias Peninsula.

On the Mangalum Island, Well No. 1, drilled by the Nederlandsche Kolonial Petroleum Mij. for the British-North Borneo Petroleum Syndicate, reached in 1916 a depth of 1,268-ft. and Well No. 2 a depth of 1,030-ft.

In western Brunei, the oil leases at Rempayoh in the Belait district were worked in 1915 by the Nederlandsche Koloniale Petroleum Maatschappij, by arrangement with the lessees, the British-Borneo Petroleum Syndicate. Well No. 2, in which oil had been found in 1914 at a depth of 1,820-ft, continued to produce at the rate of four tons a day. As no storage was available, no reliable estimate of the well's yield could be made. The well was pumped intermittently for a few days at a time in the daytime only. The yield continued until June, 1916, when it amounted to 1,500 gallons per day. As at that date, the oil was no longer required for fuel and there was not storage for it, the pump was withdrawn and a lead pipe connected to allow the gas and oil to escape.

Well No. 4 had reached a depth of 2,132-ft. by February 19, 1916. Operations were finally suspended on April 5, 1916, because of difficulties with the casing. Work was finally abandoned by the Nederlandsche Koloniale Petroleum Mij. in August, 1916. An agreement was made in 1918 with the D'Arcy Exploration Co., Ltd., for a further examination of the Belait field. Exploratory work was conducted in 1919 by the geologists of the D'Arcy Co., but the results have not been published.

In the East Tutong field, Temuan district, the Anglo-Saxon Petroleum Co., drilled a test well in 1915 at Paya Minuman, near Kampong Ikas, about five miles from Lubok Tibangun on Temuan River. The first well was abandoned in 1917 and a second well was drilled at Sembatang on Tutong River. Well No. 2 was sunk to a depth of more than 2,500-ft. Slight shows of oil and gas were met, but no substantial results were obtained. Operations were suspended in 1919.

The Shanghai-Langkat Co. drilled at Jerudong, but difficulties with sliding formations caused the abandonment of the lease in 1915. A prospecting license to a field lying 25 miles west of Tutong River was obtained. Drilling commenced late in 1916, but was abandoned early in 1917.

Production.—Commercial production of petroleum in British Borneo began in 1912 in the Miri field of Sarawak. The development of the industry is shown by the following statistics:

PRODUCTION OF CRUDE PETROLEUM IN SARAWAK, 1912-1920

	Metric Tons.*		Metric Tons.*
1912	5,534	1917	77,604
1913	30,562	1918	72,511
1914	65,185	1919	85,695
1915	67,000	1920	146,729
1916	90,067		

Character of Oil.—The crude oil of Miri is a thin fluid oil, brown in color, and translucent. Its specific gravity ranges from 0.890 to 0.925, and its viscosity (Redwood II.) at 10° C. is 45 seconds. It yields about 20 per cent. of a benzine low in volatile factions, about 30 per cent. of kerosene, and a residue of thin oil of a low cold-test. Of the kerosene fraction 25 per cent. is absorbable in 100 per cent. sulphuric acid. The crude oil contains 0.4 per cent. of sulphur and no asphalt insoluble in alcoholic ether.

The benzine fraction was found, on analysis, to contain 80 per cent. of naphthenes 15 per cent. of paraffines, 0.4 per cent. of benzine, 1.9 per cent. of toluene, 1.5 per cent. of xylenes, and 1.0 per cent. of high aromatics.

A dark-brown petroleum from Sarawak, with a specific gravity of 0.924, reported by Redwood, yielded on analysis 94.3 per cent. of lubricating oil, and 3.3 per cent. of coke. A heavy oil from Labuan, with a specific gravity of 0.965 at 76° F., gave 97.1 per cent. of lubricating oil and 2.6 per cent. of coke.

Transportation and Refining.—The crude oil from the wells at Miri is delivered by a pipe line to Lutong, where a refinery on the Trumble system was built in 1917 and 1918. It began operations in 1919. Two 8-in. submarine pipe lines from the refinery permit the rapid loading of steamers.

Prior to the building of the Lutong refinery, a part of the crude petroleum from Miri was shipped to Sumatra to be refined. Statistics of these shipments, from official Dutch sources, follow:

IMPORTS OF CRUDE PETROLEUM FROM SARAWAK INTO THE DUTCH EAST INDIES, 1913-1919.†

	Liters	Barre's
1913	..	..
1914	7,079,056	44,528
1915	27,107,335	170,505
1916	12,222,962	76,882
1917	1,934,798	12,170
1918	2,801,160	17,619
1919	2,955,260	18,589

In 1914 and 1915 these shipments were landed at Palembang, Sumatra, to be distilled at the Pladjoe refinery. A part of the 1916 shipments was sent to Pangkalan Brandan, east coast of Sumatra, and Balikpapan. From 1917 to 1919 the Miri oil was refined at Pangkalan Brandan.

* Annual reports, Royal Dutch Co.
† Statistiek van den Handel en de In en Vitvorrechten in Ned. Indië.

NEW RAILWAY LINE, JAPAN.—The Imperial Government Railways will build a new line during 1923 from Kisarazu on the west coast of Chiba prefecture on Tokyo Bay, to Ohara-machi, on the Pacific coast, passing through Kururi and Okita, across the Boshu peninsula. Chiba prefecture operates a line between Kisarazu and Kururi, a distance of 14 miles, which will be transferred to the department of railways without cost to the central government. The cost of constructing the line is estimated at Y.4,200,000. Something like Y.1,200,000 will be used to improve the existing line, and the balance of Y.3,000,000 in constructing the new line between Kururi and Ohara.

* * *

ASANO CEMENT COMPANY EXTENDS WORKS.—The Asano Cement Company operates five mills, located respectively, at Tokyo, Moji, Kawasaki (near Tokyo), Hokkaido and in Taiwan. The Moji mill is equipped with a 200-ft. furnace with a capacity of 55,000 barrels a month, the others with 100-ft. furnaces with capacity of 20,000 barrels a month. The recent active demand for cement in the Japanese market, which has kept prices up to war-time levels, has determined the company to extend the equipment of the factories. The Moji works will install two additional 200-ft. furnaces before April and the Tokyo Works another 100-ft. furnace by February.

These new additions will increase the manufacturing capacity of the Asano Cement Company from 2,500,000 barrels a half-year to 3,040,000 or 3,050,000 barrels. This company will then produce 64 per cent. of all the cement manufactured in Japan by 23 companies.

The
FAR EASTERN MOTORS
MOTORING - AERONAUTICS - MOTOR BOATING

Tokyo-Yokohama Motor Road

UNDER the direction of the prefectural governments of Kanagawa and Tokyo, a first-class national road 69,868-ft. long is now being constructed between the two cities. The Tokyo authorities are building the section between Shinagawa and Rokugo River, the boundary of the prefecture, and the Kanagawa authorities the section from Aoki-machi, Yokohama city to the Rokugo River.

The district between Tokyo and Yokohama is densely populated, and the only road between the two cities is hopelessly inadequate to the necessities of travel. An automibile trip consumes more than an hour and a half, and the difficulties of driving through the constant stream of traffic in both directions make it far from a pleasure ride. When the new road is completed, however, the motor trip will consume less than a half-an-hour, and the effect of the opening of such a road should be to stimulate the use and sale of automobiles in this part of Japan.

The Tokyo government is now engaged in construction in the neighborhood of Shinagawa, and the Kanagawa government in the vicinity of Namamugi. The actual work has been delayed two years by difficulties in obtaining a right of way. These, however, are now settled, and construction will continue undisturbed until the road is finished.

About 2,580-ft. of the road between Minami Banba, and Kaianji, near Shinagawa, have been completed. Work between Kainaji and Yatsuyama, the starting point in Tokyo city, has recently been started and the entire construction is expected to be finished in 1924.

According to a recent publication of the department of home affairs, July 1922, the road between Yatsuyama and Omori, a distance of 19,080-ft., will be 72-ft. wide, the rest of the distance between the two cities it will be only 60-ft. wide. The central part of the road, exclusively for the use of wheel vehicles, will be 48-ft. wide, and there will be concrete sidewalks on both sides, 12-ft. wide. The centre of the 48-ft. wide roadway, 22-ft. will be finished in asphalt concrete, and the side parts with asphalt. Poplar trees will be planted on both sides of the road, eighteen feet apart.

The total cost of construction has been estimated at Y.7,479,189, to be expended as follows :

1918, fiscal year	.. .. ..	Y. 186,000
1919 ,,	.. .. ..	507,740
1920 ,,	.. .. ..	1,684,047
1921 ,,	.. .. ..	2,269,481
1922 ,,	.. .. ..	2,831,921

(Fiscal Year=April-March).

The funds are being obtained by public loans, and through subsidies from the national treasury. The central government pays for two-thirds of the cost of re-building the bridge across the Rokugo River, 1,680-ft. long, and one-half of all other construction costs. So far, the following amounts have been expended :—

1919, fiscal year	.. .. ..	Y. 86,000
1920 ,,	.. .. ..	150,000
1921 ,,	.. .. ..	320,330

Two licenses for construction were issued in 1921. One on March 30, for the distance between Yatsuyama, Kitashinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture, and Higashi Sengendai (Kaianji), Minami Shinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture. The road to be 48-ft. wide, with sidewalks on both sides, 12-ft. wide. The license provides for the construction of a bridge across the Meguro River, made of steel and concrete, 40-ft. long and 72-ft. wide. The total cost of construction was licensed at Y.620,312.

The license issued on May 5, 1921, was for the district between Kaianji, Higashi Sengendai, Minami Shinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture, and Ipponmatsu, Oi-machi, Ebara-gun, Tokyo prefecture. The road to be 48-ft. wide, the sidewalks 12-ft. wide on each side of the road. A bridge is to be built across the Tachiai River, "T" type steel and concrete, 25-ft. long, and 72-ft. wide. The total cost of construction licensed is Y.446,090.60.

Kanagawa Prefecture.—Construction in Kanagawa prefecture will be between Aoki-machi, to the bridge across the Rokugo River. The total length of the road in this prefecture will be 34,728-ft. From Aoki-machi to Koyasu-machi, Irie-bashi (Bridge), the road is to be 72-ft. wide, the rest of it will be 60-ft. wide. The forty-eight feet of roadway will be finished in asphalted pebbles. The sidewalks of twelve feet width on each side, will be covered with pebbles. The road where it is 60-ft. wide will have a central roadway of 42-ft. width, finished in asphalted pebbles. The sidewalks of 9-ft. each will be covered with gravel. Three bridges must be built in this prefecture,—but no definite plans for construction have yet been adopted. This section of the road will also be bordered with poplar trees, thirty feet apart.

Costs of construction of the Kanagawa section of the road are estimated at Y.2,834,816, to be expended as follows :

1918, and 1919 fiscal years	.. ..	Y. 89,289
1920, fiscal year	.. .. ..	1,095,428
1921 ,,	.. .. ..	915,365
1922 ,,	.. .. ..	915,365

The national treasury will pay half the costs of the road construction, and two-thirds of the cost of building the Tsurumi bridge.

So far there has been expended : 1919, Y.94,000 ; 1920, Y. 248,000 ; 1921, Y.249,000.

Harley-Davidson Motor Cycle for Special Delivery of Hand Baggage in City Limits, used by the Tokyo Railway Bureau

Auto Delivery Vehicles in Japan. Tricycle Delivery Wagon

Ford Delivery Truck used by the Hakuban-Kirin Publishing House

AUTOMOTIVE JAPAN

Service Facilities

(Interview with W. I. Irvine, U.S. Trade Commissioner)

WHEN the question of service is broached to Japanese dealers they always answer in the affirmative but upon examination it is found that in the majority of cases, service by their conception differs radically from the American understanding. As the Japanese see the problem it means principally carrying spare parts. All of the dealers have facilities for making repairs, however, limited, from well-equipped machine shops to a small garage equipped with a few crude machine tools, but this service is only provided where the main office is located. Dependence for repairs outside of these centres is placed upon local garages which are poorly equipped to do good work at low cost.

There is a lack of understanding and appreciation of the value of good service to the sales organization, the attitude being to regard repairs as a highly profitable business. No special effort is made to induce owners to bring their vehicles to the seller for repairs with the result that cars and trucks of every make may be found in almost any dealer's workshop. And it is not uncommon to find spare parts for cars other than those sold by the dealer on the shelves of his stock room.

Complaints against this lack of service come only from the foreign owner, especially Americans who have enjoyed the advantages of service in the home country. Japanese owners have not been educated to expect differently from what they are getting and there is no tendency to enlighten them. Were dealers to emphasize their service a beginning would be made in breaking down the chauffeur evil. As the situation now rests chauffeurs take the cars to those shops where charges are highest for them the proportion of the driver is greater. This together with the high prices for spare parts contributes greatly to the truth of the statement that ownership of a car is expensive.

When a man leaves a car for repairs he rarely knows what the cost is to be for the practice of giving estimate is not followed by dealers and even should insistance call forth a figure it is not guaranteed. The only explanation offered by the dealers is that the mechanics cannot tell what the difficulty is until they have made a thorough examination, nor can they judge how many hours it will take to do the work, the time varying 100 per cent. on the same kind of repair in many cases. When the work assumes anything like the proportions of a major repair the idea of the Japanese mechanic is to tear down the whole machine, and during the visits of the writer to the service stations it was not an uncommon thing to find cars completely disassembled with parts scattered around the floor in hopeless confusion, men spending precious time searching for a missing piece.

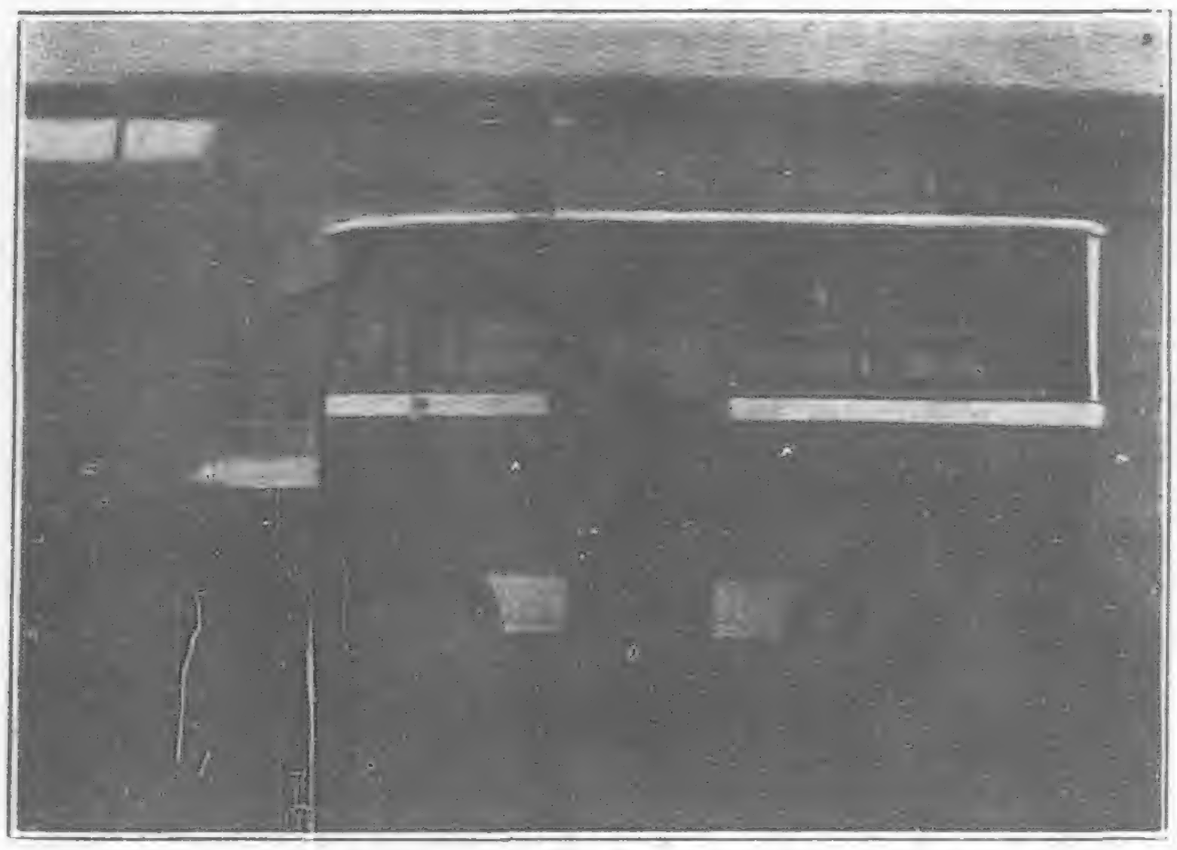
With but few exceptions the stocks of spare parts are poorly kept. Evidence can be found of systems but the original plan of systematic filing in separate bins has been lost sight of and an examination of bins showed a conglomeration of parts that would give an efficient storekeeper a nightmare. So it is not a matter of wonder that repair jobs are delayed for weeks while a new part is being machined and later to find the part in stock. In some cases stocks are not conveniently stored and one of the largest dealers was found to keep slow moving parts in the emergency stock room in the centre of the city while frequently called for pieces were stored in the shop four or five miles away.

The machining of parts is frequently due not only to the lack of proper storage systems but to the poor selection sent by the

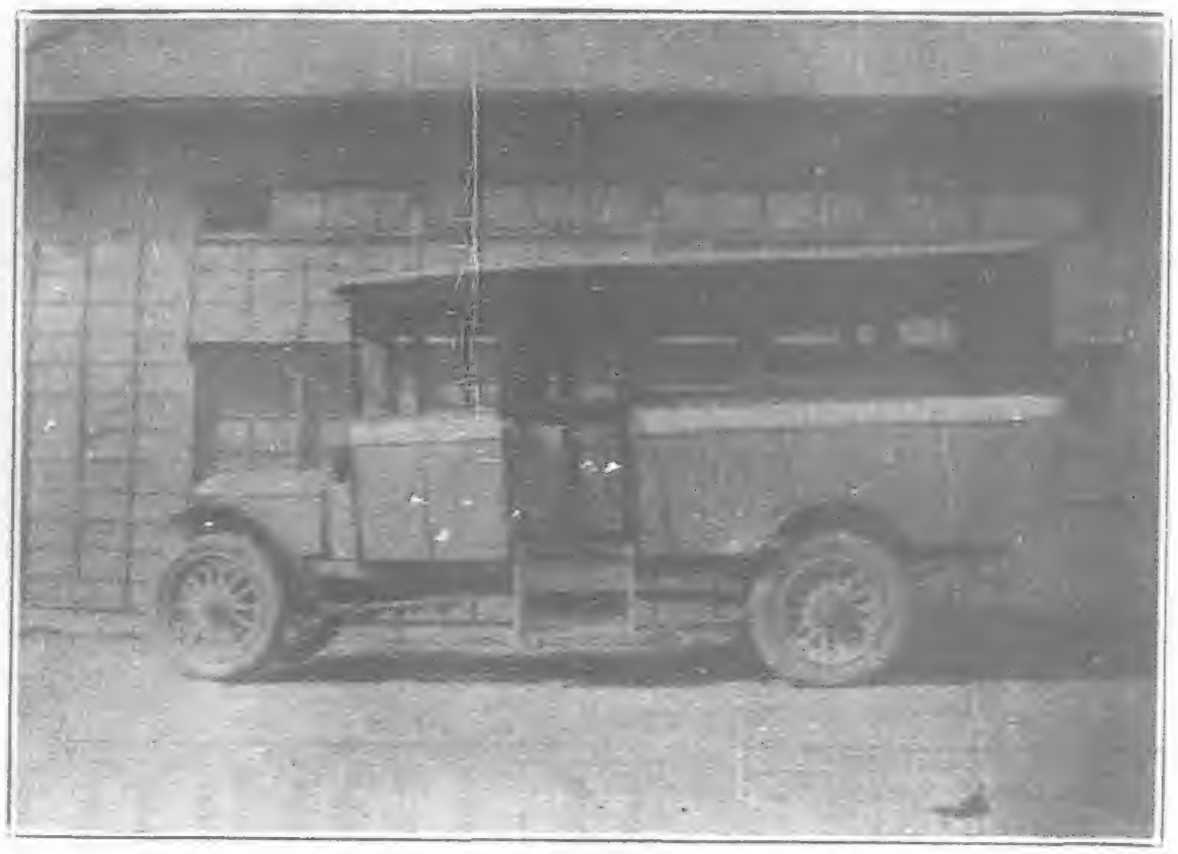
Ford One-ton Delivery Truck : Fuji Brewery Company

Federal Two-ton Small Baggage Truck: Imperial Railway Department

2-ton Diamond "T" Delivery Truck: Asano Cement Company



Small Type Bus



Large Type Bus

TYPES OF PASSENGER BUSES ON REPUBLIC TRUCKS OPERATED BY THE TOKYO BUS COMPANY

American manufacturers with the result that at times dealers are compelled to have parts made while carrying a large investment in parts stocks which creates the impression that parts carrying is an expensive and useless procedure, a natural evil to the business selling American cars as European manufacturers do not insist on the same condition.

The statements of dealers as to the charges made for spare parts do not agree with the claims of owners interviewed and from the attitude of some dealers towards the spare parts question it would appear to some extent that the complaints, especially of foreigners, are justified. Many dealers feel that they must charge not only the costs of storing and other natural expenses but add on saleable parts the probable loss on dead stock. Prices for parts run anywhere from 73 per cent. to 300 per cent. above invoice value.

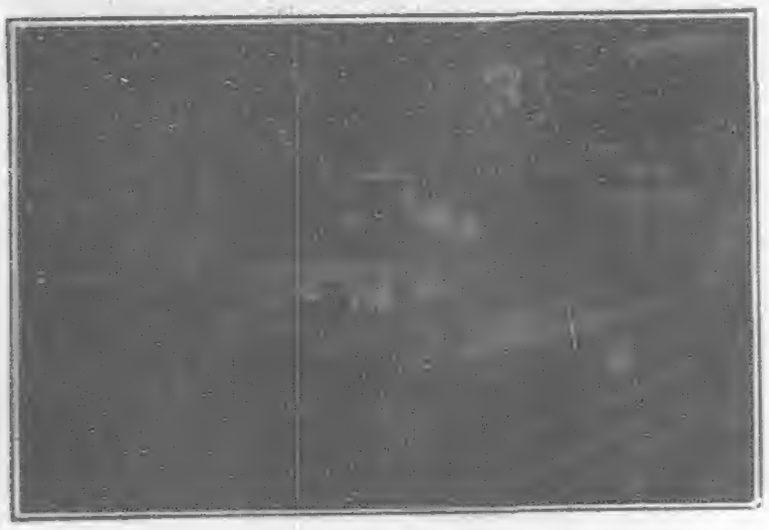
Spare parts stocks are almost without exception kept at the main establishment. Dealers say that they have so few vehicles in each city that it is not profitable to carry an assortment at their branches, which is further evidence that the market would be better served if division of territory were made. With but one exception it was found that the stock record systems are not used outside of Tokyo. The exception was in the case of a distributor of a very low price American car who not only carried parts in every branch but provided bins in which each movement in and out was recorded.

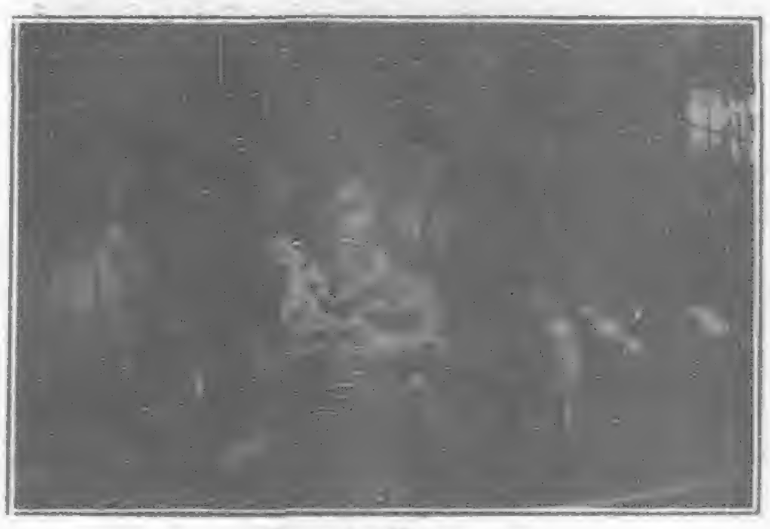
Another View

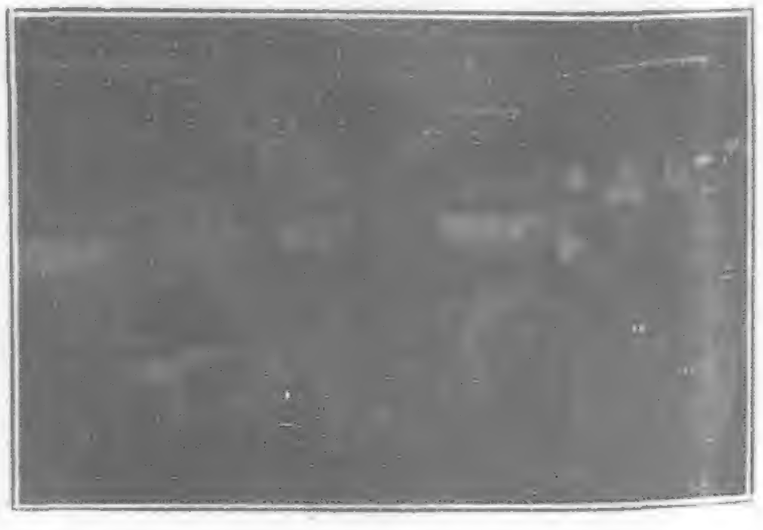
Imitation of Spare Parts

In the case of one well-known car, parts are frequently imitated and sold a trifle under the set price of the authorized pieces. The imitations are stamped with a name in the same type as the original. The first letters are the same but the last letter is blurred making it appear as though it were due to faulty stamping. In appearance the parts look like the original but the distributors claim that the materials used are below the manufacturer's standards and do not wear.

Traveling service representative from Europe have yet to make their appearance in Japan, although a few service men from the factories of the high-grade cars arrived with first consignments to instruct mechanics in the car details and to tune up the first cars. Nor are the European manufacturers insisting on the carrying of spare parts, and, as an illustration of their attitude on this point, the experience of one dealer is illuminating. During the war he could not get cars from a well-known French manufacturer and so took the agency for an American car. He was thoroughly convinced on the value of the spare parts policy as he had made an investigation of American automotive rpactices before making his agency selection. He maintained a repair shop and carried in a fairly systematic way a supply of spare parts. Unfortunately the car he selected to sell was not comparable either







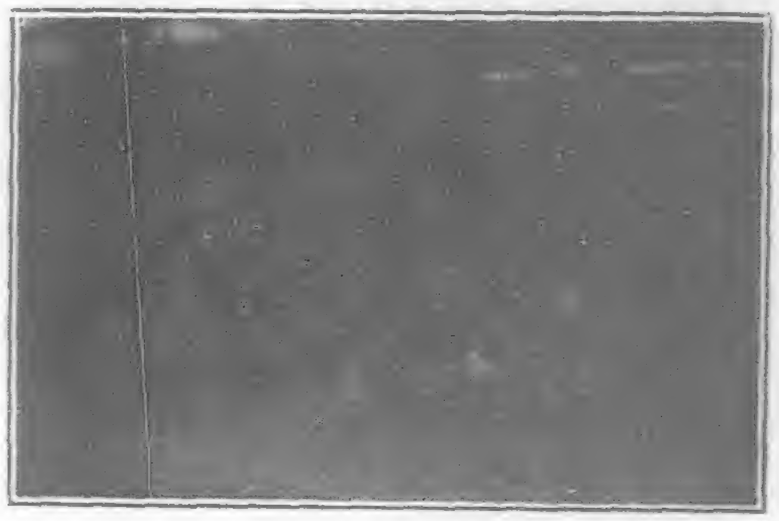
Repair Shops

in mechanical perfection or in price with the French car so, when the manufacturer of the latter was again in position to supply, the dealer put his stock of American cars in the hire business and ordered a stock of French cars together with a full supply of spare parts. The manufacturer strongly objected on the ground that the order was an implication on the durability of the car and refused to furnish the parts at once. The parts did not arrive until a year after the cars had been received, according to the dealer's statement.

Absence of Good Public Garages

Aside from the facilities provided by the dealers there are practically no good garage in Tokyo and other cities. The public garages are merely places to store cars and any repairs made there are done with the most inadequate tools and generally in the street as there is insufficient room in the majority to work freely, the average garage having room for not more than six cars. It would seem, therefore, that there is a splendid opportunity for the opening of a well appointed garages in a central location and it is suggested by some car owners in Japan that American manufactures set up a model, establishment which would not only serve vehicle owners but would demonstrate to dealers how to run efficiently a service station. Unless such a station were directed by Americans and had a few mechanics from the United States it is doubtful if such an experiment would succeed. However, there is no doubt that a useful service could be performed by such an establishment for from the foregoing it can be seen that the inefficiency of this branch of the distributors function is operating as a deterret to the popularization of motor vehicles.

Type of Passenger Bus on Republic Trucks operated by the Tokyo Noriai Jidosha Kaisha: Passengers Boarding Bus in Front of Shimbashi Station. A Popular Beer Advertisement is shown on Back of Bus.



Repair Shops

TOKYO PASSENGER BUS SERVICE

Views of Assembly and Repair Shops of the Tokyo Noriai Jidosha Kaisha (Tokyo Bus Company), Operating a Fleet of Republic Trucks on Tokyo's Main Thoroughfares.

Uniform Car Tariffs Favored

SENTIMENT in favor of uniform international tariffs on motor cars is gaining ground abroad, is the opinion of H. H. Rice, treasurer of the national automobile chamber of commerce, who has just returned to New York from Europe.

He found that the new American motor tariff offering lower duties to those countries which favor the United States is creating a receptive attitude abroad. A good deal of protectionist sentiment remains, to be sure, but lower duties for United States automotive products are being seriously considered in many quarters.

Spain, Italy, Belgium and Holland have already benefited from the new motor tariff. Formerly the United States duty was 45 per cent. on automobiles costing over $2,000, but it is now as low as 25 per cent. for the products of all countries which accord the United States equivalent treatment. Moreover, this tariff reduction clause in the final writing of the bill was made automatic, so that any reduction abroad wins immediate favorable treatment here without awaiting executive action.

Motor Boats in Japan

LAST summer motor boating was all the fashion in Tokyo. Other parts of the country showed a remarkable increase in motor boat registrations both for pleasure and business. The increased interest in motor boating in Tokyo was, however, popularly attributed to the "hard times." In prosperous years one of the favorite amusements of the tired Japanese business man consists in giving elaborate parties at the different popular summer resorts. Because of their cost such parties were exceedingly few and far between last summer. The summer was hot, though, and somehow or other society had to be amused. The daily papers reported that the hard hit merchants had solved the problem of keeping cool and entertaining their friends by riding up and down Tokyo's river, the Sumidagawa, in rented motor boats, at ten yen an hour. So, as long as the "hard times" continue, motor boating bids fair to remain a popular sport, in Tokyo at least, yet in all seriousness, the sport is steadily gaining in favor with those of ample means, while in the business world the use of motor-driven boats is constantly growing.

Until 1917, the only motor-driven boats in Japan were pleasure boats. To-day a great number of launches, tug-boats, and fishing boats are equipped with gasoline motors. The principal demand is for motors of 10 to 40 h.p., gasoline fuel. Popular motors for commercial vessels are the Universal and Doman; for towing many Fay and Bowen, and Regal motors of 40 h.p. are being sold and, because of its very low price, the Kermath motor of 40 h.p is finding many purchasers.

The types of motor boats in use in Japan may be described as hydro-plane, runabout and cruiser, the V shaped runabout being most popular for pleasure boats. The average length is from 20 to 30-ft., with 4 to 6-ft. beam. The types of inboard motors more frequently seen are the Fay & Bowen, Universal, Hess Mono-Marine, Domon, B.W.M. (German), and Hall Scott, all of which are sold by the Yamato Trading Co., of Tokyo. The Kermath Mfg. Co., the Scripps Motor Co., Knox Motor Associates, T.V.B. Engine Co., Wisconsin Motor Mfg. Co., and Niagara Motor Corporation, are represented by the Motor Boat Shokai of Tokyo. The Elto motor is represented by the Kachi Shokai of Kobe, and the Kaneko Shokai of Tokyo, is introducing the Daimler, the American Regal and Red Wing motors.

Excluding fishing vessels, the number of motor boats in Japan with inboard motor installations is very small. In Tokyo and its vicinity, there are about 50, of which 35 are for pleasure; in Yokohama, there are 18 pleasure and 5 commercial motor boats; in Osaka there are 20, and on Lake Biwa, Japan's greatest lake, 12; in Kobe, 15, and registered at the Inland Sea ports there are another 20 motor vessels. Kyushu has 20 more. In addition, there are about 140 more in use by the different government departments, the navy and the naval flying corps owning 80. The total is only slightly over 300, and it is said that over 90 per cent. of the motors are of American make.

The motor most frequently seen is the Universal marine, type C3, 12 h.p., which is used in fishing, commercial and pleasure boats. Practically all fishing boats are equipped with this particular make. Many 4 h.p. Hess mono-marine motors are installed in Japanese fishing vessels, while the Domon marine engine is also finding favor in this field. About 20 German B.M.W. motors are installed in tow boats and cruisers. The Kermath motor of 3 and 4 h.p. is found exclusively in pleasure boats, but recently their use has been extended to fishing boats. The Scripps' motors are found usually in cruisers, 40 to 60 h.p. being the favorite sizes. The Scripps, the Wisconsin and B.M.W. 60 h.p. motors are being used with air propellers on passenger vessels of shallow draft on streams with swift current.

Outboard Motors.—It is difficult in Japan to sell high priced inboard motors in competition with the less expensive outboard types of 3 to 5 h.p. The Evenrude, Miller, Caille, Ferro, Waterman, Elto and Koban, detachable motors of American manufacture, and the German Hass and Tip-top are all sold in this market. There are more than 1,700 Evenrude motors in Japan, sold through the Hinode Shokai of Tokyo, with only 400 of all other makes. This makes 2,000 as the total number of outboard motors in use, of which 80 to 90 per cent. are American makes.

The outboard motor is used for any and all purposes, but the 2 h.p. motor for use in a 24 by 4-ft. boat is the one in greatest demand. The Miller outboard motor is used chiefly for pleasure boats, and the Hass motor of 2½ to 5 h.p. for small cargo sampans.

Not one per cent. of the total number of motors installed in Japanese boats are of Japanese manufacture, but the boat bodies are all made in Japan. Importers of motors have their own body building departments, and there are many small shipbuilding concerns which specialize in this class of work. The most widely advertised of these concerns is the Nihon Jidotei Kabushiki Kaisha (The Japan Motor Boat Co., Ltd.) of Otsu, Shiga prefecture, on Lake Biwa. This company is capitalized at Y.620,000, and it is now making almost all the best motor boats for the government departments and private persons.

Fishing Vessels.—At the end of 1921 there were 6,270 registered fishing boats equipped with motors, having a total of 129,813 h.p., an average h.p. per vessel, of 20.7, and an increase of 689 over the previous year. This increase, in the face of the serious financial depression, is proof that the use of motor power in Japanese fishing vessels is increasing in popularity. The number of steam power fishing vessels actually registered decreased to 4 in 1921. Motor fishing vessels showed an average decrease in tonnage of 0.2 tons, and an average decrease in power of 0.8 h.p., indicating that the fishermen are recognizing the advantages of small motors for smaller fishing vessels. There were remarkable increases in the number of motor-driven fishing vessels registered in Shizuoka, Chiba, Kanagawa, and Fukui prefectures, all centres of the fishing industry.

Cruising.—Japanese waters are ideal for cruising, except during July and August, and in early September when typhoons are frequent. During the rainy seasons in June and September it is not pleasant to be out at sea, but there is little wind blowing. In the Japan Sea during the winter the waves are extremely high, and cruising even in steam vessels is none too pleasant at times. There are hundreds of fishing villages where landings can be made, but foreigners operating vessels of foreign registry are not permitted to enter other than the so-called "open ports." Several unpleasant incidents have happened in the past, when foreigners not properly acquainted with the Japanese regulations have put into "closed" ports.

For Japanese vessels there can be no more delightful experience than cruising from port to port, particularly in the Inland Sea during the summer months. The excellent and frequent harbors make danger from sudden high winds almost negligible. The Inland Sea is, therefore, the favorite summer cruising ground for Japanese motor boat enthusiasts.

Even Japanese motor boats and their owners are subject to severe cruising regulations the vicinity of fortified zones enforced by the commandant of each zone. It is therefore very difficult for the cruiser to know in advance just what rule he may infringe when he enters a strategic zone. In fact, it is often only when several such rules have been inadvertantly infringed that the cruiser discovers the fact. The strategic zones are located at Yokosuka, Kure, Sasebo, Maizuru, Chinkai, Takeshiki, Make, including islands of Gyo-e, Hakusa, Hoke, Ominato and Eike. Waters in the vicinity of important fortresses are also under strict regulation for cruising; these fortresses are: A part of Tokyo Bay; Hakodate, Yura, Maizuru, Gaiyo, Hiroshima Bay, Shimonoseki, Sasebo, Nagasaki, Tsushima, Keelung, Chichi-jima in the Bonin Islands, Hoye, and Amami Oshima. Natural conditions for motor boating are almost ideal in Japan, but the regulations governing cruising are so restrictive that the pastime is not an unmixed pleasure.

Regulations for Use of Motor Boats.—Pleasure motor craft are subject to no particular regulations as regards operation. They must, however, be registered in the prefecture when they are to be used, and are subject to a tax of 20 sen a ton. Commercial motor boats are subject to these taxes in addition to the ordinary business taxes. Commercial boats must carry signal bells or fog horns, and are required to exercise the greatest care in traffic centres. Commercial vessels are those operated by steam, oil or other power motors, operating along the coast of Japan for the purpose of transporting passengers, freight, or engaging in other business. Those who wish to operate such steamers must obtain permission from the police authorities. They must be under charge of a properly qualified captain, engineer, with a licensed crew. Motor boats for rent are subject to no special regulations.

Despite the many suitable waters for cruising the use of motor boats for pleasure is not very extensive, due principally to the many vexatious restrictions on operation and cruising placed on the sport by the military and police authorities. The Nihon Jidotei K.K. is now endeavoring to obtain official support to the organization of a club to promote motor boating in Japan, propagating the use of motor boats as a valuable assistance to life-saving stations, and for use in cases of emergency, such as floods, fires, shipwrecks, etc. This club will probably be organized before this summer.

Opportunities for the sale of motors for pleasure and fishing boats are extremely good. The small motors of not more than 60 h.p. are most in demand, although the 12 h.p. motor is the favorite. The outboard motor is becoming increasingly popular, and a large business awaits the manufacturer of a motor able to compete with the Evinrude in quality and price. As a matter of fact, quality if of no particular interest to the Japanese fisherman, cheap price being the first consideration. Of course, motors whose performance records are poor can hope for little business, but a low price, medium grade outboard motor has a very good chance of doing a large business in Japan.

As for the inboard motors, most of the world's best motor manufacturers are represented in this country already. The market practically belongs to one or two makers. But a new motor coming on the market, capable of competing in price and efficiency with the established makers stands a good chance of making good sales. It is purely a matter of advertisement, and personal sales work among the people interested.

Companies in Japan Manufacturing and Dealing in Motor Boats, Motor Boat Engines and Supplies

Motor Boat Shokai Kabushiki Kaisha.—This is the oldest concern in this business. Office: Tsukiji No. 15, Kyobashi Ku, Tokyo City. Managing Director: Shigeo Yoshida. Dealing in American and German motors. Agents for the B.W.M., Scripps-Booth, Buffalo, Knox, Sterling, etc.

Yamato Boeki Kabushiki Kaisha.—Office: 1, 6 chome, Irifune Cho, Kyobashi Ku, Tokyo City. President: Kozo Uchida. Opened to business: 1917. Agents for the Fay, Bowden, Universal and Peerless motors.

Nakaya Shoten.—Office: Nishibei Shintaku Building, Kitamaki Cho, Kyobashi Ku, Tokyo City. Owner: Makoto Onomoto, formerly in business with the Denmark Trading Co., of Kobe. Dealing in high-class American marine motors; motors for use in fishing boats. Agents for N.S.U. and Universal types, Matthews generators, Waterman motors, carpenter's tools for ship use, search lights, and pumps.

Hosaka Kikai Seisakujo.—Office: No. 4, 2 chome, Hamacho, Nihonbashi Ku, Tokyo City. Owner: Hosaka. Designer and repairer of motor boats. Sells American and other motors.

Hinode Shokai.—Office: No. 14, 3 chome, Minami Denma Cho, Kyobashi Ku, Tokyo City. Importers of motors of the Evinrude type. Agents for the Evinrude motor. Also imports ans sells other motors.

Kaneko Shokai.—Office: Hanakawado Machi, Asakusa Ku, Tokyo City. Owner: Ikuhisa Kaneko. Imports German, Daimler, Red Wing, Commerce, Ragal motors. Operates in conjunction with the Nihon Motor Boat Co., on Lake Biwa.

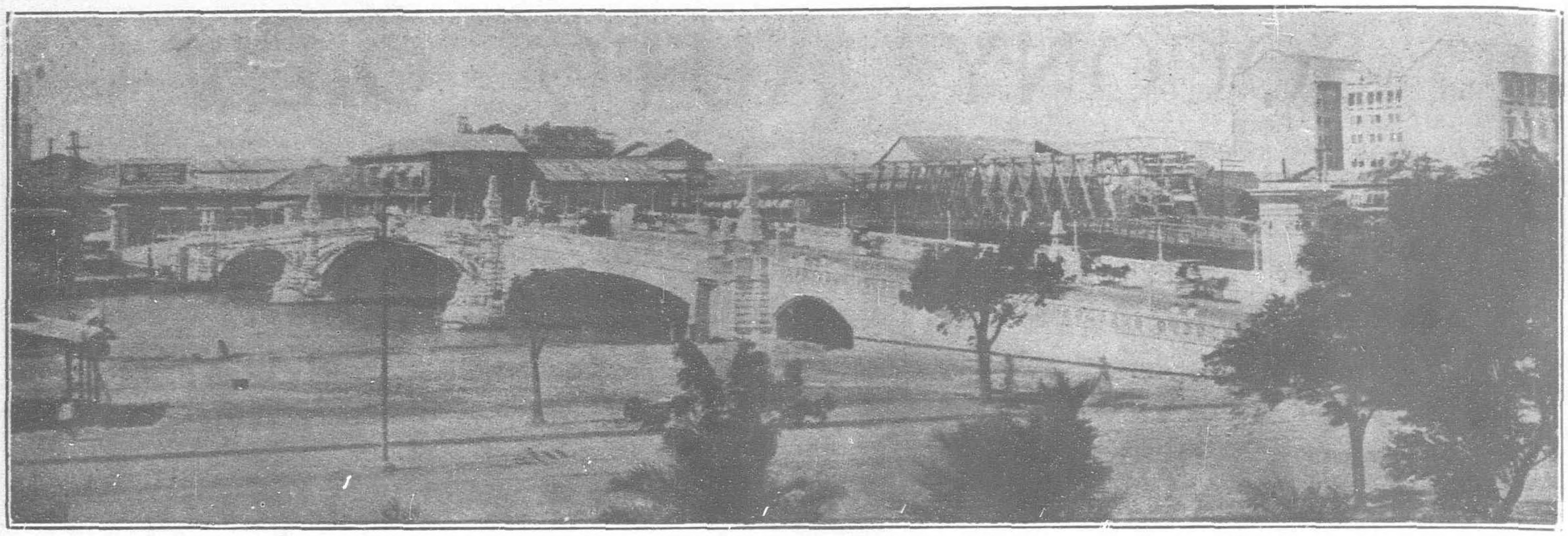
Sumidagawa Zosenjo.—Office: Mukojima, Tokyo Fuka. Operated by Shinhachi Takahashi. Designers and constructors of motor boats and other vessels.

Nihon Jidotei K. K.—Office: Biwako, Otsu, Shiga Prefecture. Designers and constructors of motors and motor boats. Imports and sells motors for sailing vessels. Rents motor boats.

Kochi Shokai.—Office: 105 Edo Machi, Kobe City. Dealers in fixed and detachable motor engines, gasoline, kerosene, etc.

K. K. Niigata Tekkojo.—Office: No. 3, 1 chome, Yuraku Cho, Kojimachi Ku, Tokyo City. Engineering Chief, Gisei Nagamoto. Consulting Engineer: Captain Ryueki Onuki, I.J.N.R. Manufacture and sale of internal combustion engines, Diesel and semi-Diesel types. Machine tools, oil well boring machinery, steam engines and boilers. Internal combustion engines, factory located at Kamata, near Tokyo. Factory site covers, 20,040 *tsubo* (*tsubo*= 36 sq. ft.) Opened to business, 1921. Equipment is the best so far installed in Japan. Does not manufacture gasoline engines. Its kerosene motors, 15 to 110 h.p., used largely for fishing boats, averaging about 5,000 h.p. in sales per annum. When the Kamata factory is completed, the present production will be doubled.

Ikegai Tekkojo.—Office: Mita Shikoku Machi, Shiba Ku, Tokyo City. Established: 1900. Manufacture of machine tools and internal combustion engines. In 1915, received orders from Russian government and completed 500 engines in 5 months. This enhanced their reputation, and the Japanese Navy and Army departments have since been the principal purchasers of their productions. Capital: Y.6,000,000. President: Shotaro Ikegai. Chief of the Engineering Department: Sugiji Ikegai. Machines manufactured: Internal combustion engines; Gasoline and kerosene burners; 10-360 h.p. semi-Diesel engines, various types; 2-320 h.p. About 10 per cent. of the output is sold to the public, official departments absorb the other 90 per cent. The Sumida Gawa Zosenjo uses Ikegai motors. Its semi-Diesel engines are used by fishing boats all along the coasts of Japan, 90 per cent. of those in use to-day being Ikegai manufacture. The company has recently begun the manufacture of 100 h.p. Bentz aeroplane motors. Sales, monthly average 1,500 h.p.



The William A. Jones Memorial Bridge, replacing the Old Bridge of Spain over the Pasig at Manila

Public Works in the Philippines

Roads

THE latest report of the Philippine government bureau of public works covering the fiscal year ending December 31, 1921 has just been issued and shows on that date a total length of 9,917 kilometres of roads in the islands, of which 4,863 are first class, 2,044 second class and 3,036 third class. Of the total, 4,906 kilometres were maintained by the bureau under the "caminero" system, a specific agreement between the insular government and each separate province.

The definition fo: road classification is as follows:

First-class roads.—Well graded and surfaced, thoroughly drained and constantly maintained. Bridges and culverts are usually complete and permanent, and, when missing, their places are supplied by ferries capable of carrying automobiles weighing two tons or more. These roads are continuously passable at all times with possible exceptions during typhoon periods.

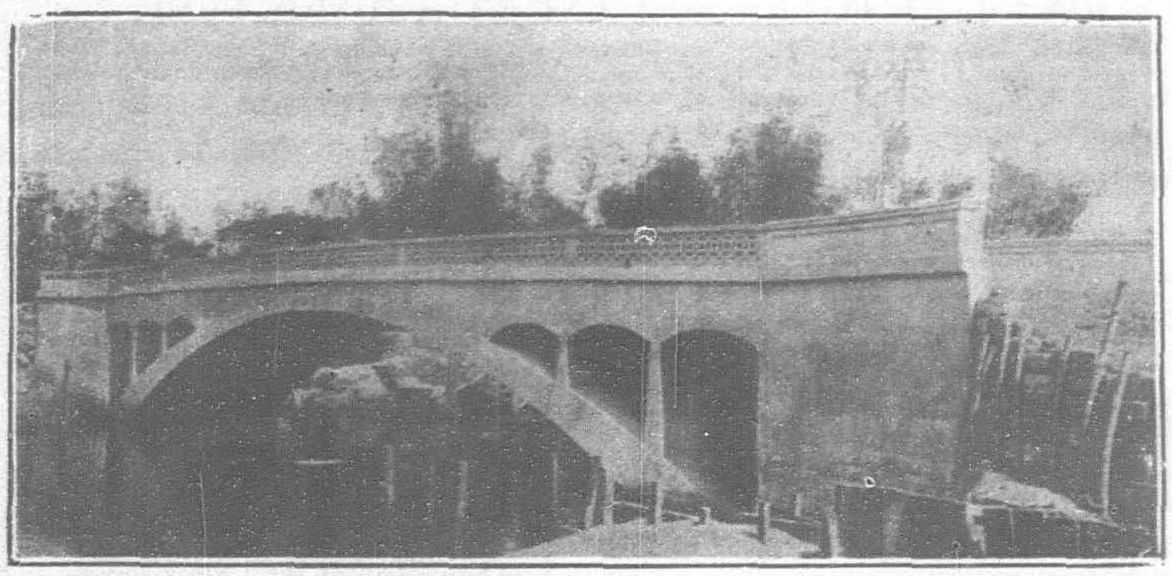
Second-class roads.—Fairly graded, partially or naturally surfaced, and generally intermittently maintained. Bridges and culverts are usually complete but, in part, are temporary structures. These roads are continuously passable for vehicle traffic during the dry season, but more or less impassable during the rainy season.

Third-class roads.—All traffic routes for carts not included in the first and second-class roads. Such roads are usually narrow, poorly graded or not graded, and generally impassable during the rainy season.

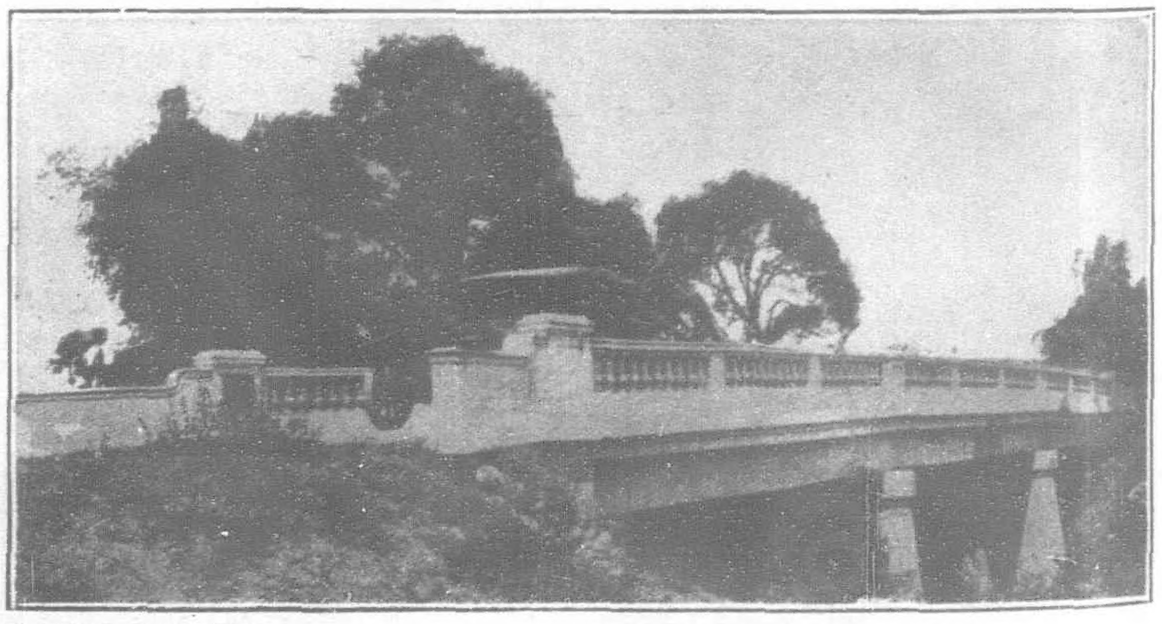
There were 4,906 kilometres maintained by the caminero system and 3,200 by the gang system, a total of 8,017 kilometres at a total cost of Pesos 3,762,218 for the former and Pesos 746,102 for the latter system, or an average cost per kilometre of Pesos 766 for the caminero and Pesos 233 for the gang system. There were 7,481 durable bridges and culverts in existence at the end of the year, a decrease of 83 over the previous period. These include structures of reinforced concrete, steel, brick and all substantial stone structures whether of adobe or other material. Of this class of structures there were 4,314 of reinforced concrete totalling 17,280 metres of span all built during the American *rêgime*, in addition to a large number of steel and other classes of construction.

Greater attention was paid during the year to road maintenance because of the ever increasing volume of traffic and the lack of proportionate increase in provincial road and bridge revenues. Very little new road construction was attempted during the year, and unless additional funds are provided a further curtailment of new construction will be necessary.

Despite the shortage of funds it was possible to construct a few important bridges, of which the following are of special note:



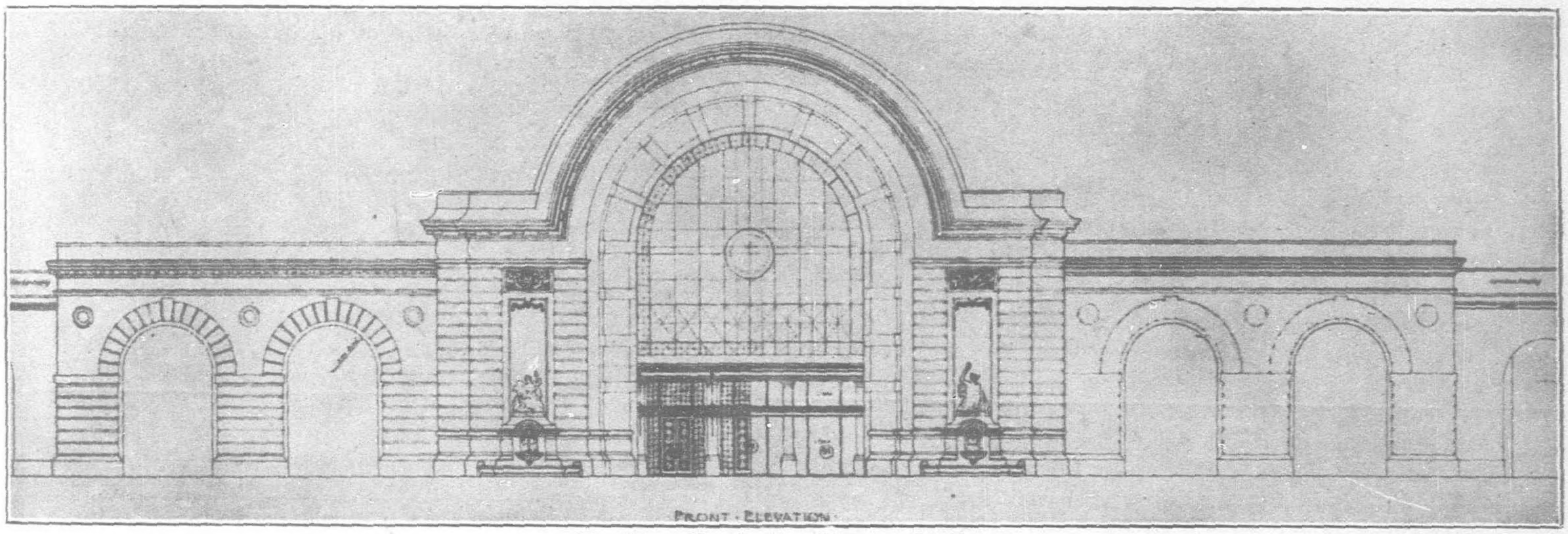
Zapote Bridge between Rizal and Cavite Provinces, P.I.
One 30 metre Span: Cost P.73,955



Mango Bridge, Montalban, Rizal, P.I.
Three 9 metre Span: Cost P.22,613

TYPES OF NEW ROAD BRIDGES

Province and Road.	Name.	Km. No.	Type.	Spans.	Roadway in metres.	Cost.
Benguet :						
Damortis R.R.Station–Baguio Road	Bued River suspension bridge	249.6	Suspension on steel towers ...	One 61-metre ...	2.135	P.24,300
Bulacan :						
Malolos–Hagonoy–Sto. Rosario Road	Hagonoy River bridge ...	53.9	R. C. slab and girder on R. C. pile bents	5 of 9-metre ...	4.88	P.43,823, 95 per cent. complete Dec. 31, 1921.
Cavite :						
Manila-Cavite Road	... Imus River bridge	20.5	Wooden Howe truss on R. C. bents.	3 of 20-metre ...	2.85	P.53,727
Occidental Negros :						
Himamaylan–Cabancalan Road	... Talaban Diot River bridge (askew).	78.4	R. C. slab and girder on R. C. pile bents.	10 of 7.5-metre ...	4.88	P.60,550, 80 per cent. complete Dec. 31, 1921.
Pampanga :						
Angeles–Mabalacat Road ...	... Abacan River concrete spillway	92.23	Reinforced concrete spillway ...	Length:232 metres.	5.00	P.26,310, 80 per cent. complete Dec. 31, 1921.
Pangasinan : ...						
Manila North Road	... Bued River bridge	176	R. C. slab and girder on U-abutments.	One 11-metre ...	4.88	P.7,431, 2 per cent. complete Dec. 31, 1921.
Urdaneta–Calasiao Road ...	... Catablan River bridge ...	213.0	R. C. slab and girder on R. C. pile bents.	5 of 9-metre ...	4.27	P.53,240
Rizal :						
Malabon–Obando Road ...	... Dampalit River bridge ...	14.5	R. C. slab and girder on R. C. pile bents.	6 of 9-metre ...	4.88	P.49,000
Mariquina–Montalban Road	... Mango River bridge ...	32.31	R. C. slab and girder on R. C. piers.	3 of 9-metre ...	4.27	P.22,613
Manila–Cavite Road... ...	... Zapote River bridge ...	15.2	R. C. arch	One 30-metre ...	4.88	P.73,955
Tayabas :						
Manila South Road	... Sampaloc concrete spillway	123.5	Concrete spillway	Length: 70 metres	4.42	P.20,623
Total expenditure for permanent bridges and spillways			... ...			P.434,592



Pier Head No. 7. Port District, Manila

Motor Vehicles

During the year there were 1,865 new motor vehicles registered and 11,476 re-registered, or a total of 13,341 as compared with 13,493 registered the previous year. Of the 1917 motor vehicles previously registered which were withdrawn from operation, 88 were reported unserviceable. In the licensing of operators, 2,000 applicants were examined and 1,595 new licenses issued. Including renewals, 16,859 drivers were licensed to operate motor vehicles. The funds collected during the year under the existing laws were P.207,275 as against P.177,263 for 1920. The amount expended for the registration of motor vehicles and for the carrying out of the provisions of motor vehicle laws was P.64,000.

Benguet Automobile Line

The Benguet automobile line operated during the year eleven touring cars, six passenger trucks and six freight trucks, and handled during the same period 3,776 first-class passengers, 4,886 third-class passengers, 92,160 kilos of hand baggage, 885,142 kilos of expresses and freight and 60,548 kilos of dead head material.

Buildings

During the year 1921, there were 148 durable buildings erected with a total content in cubic metres of 363,735 of which 71 per cent. was of reinforced concrete. Among the buildings completed in Manila during the year was the executive building occupied by the office of the governor-general. This structure is undoubtedly the finest example of the possibilities of local materials and artisanship in the islands to-day. The unit cost per cubic metre of enclosed space is very high as compared with other buildings, but fully fifty per cent. of the cost is represented by the special marble finish, carved wood work, wrought iron work, imported electrical fixtures and sample furniture. It has been demonstrated by the results obtained in this project that although the special marble finish is preferable to the ordinary cement finish so far as appearance is concerned, the cost and difficulty of obtaining it, however, make its use inadvisable except in very special cases.

Rizal Hall, for the University of the Philippines, was completed at the close of the year 1921, except for minor work on electrical wiring. The building itself is an architectural duplicate of university hall. It has steel roof framing and a reinforced con-

crete roof slab, overlaid with asphalt-impregnated water-proofing, with flat, inter-locking tile roofing.

The foundations for the new post office building were practically complete at the close of the year. The Atlantic Guilf and Pacific Company satisfactorily furnished and drove the 4,800 wooden piles for this job, but were obliged to omit approximately 40 piles because of the non-removal of the Meralco tracks and wires.

The addition to the bureau of printing, which will house the photo-engraving division, the machine shop, and the foundry, was completed during the year.

The maternity pavilion and the dining pavilion for the Philippine General Hospital were practically completed at the end of the year. As a whole, this project presents a very pleasing appearance and is certainly superior to the old units.

The reconstruction of the intendencia building has been carried on by administration throughout the year. The entire second floor, which was formerly of wood, was removed and replaced by reinforced concrete slabs and beams. A new roof framing was constructed composed entirely of steel supported by reinforced concrete pilars and beams. This steel framing was fabricated and erected by contract at a cost of approximately P.60,000. The roofing is of 22-gauge corrugated galvanized iron strapped to the steel purlins with 18-gauge galvanized iron straps. The ceiling joists being of steel, and the ceiling itself of asbestos, practically eliminates all the wood work formerly utilized in this structure.

In the provinces a number of important buildings were erected during the year, most of which were standardized school and provincial official buildings of various uses.

Port Works

The proposed port works program for the archipelago suffered a set-back during the year, due principally to the financial depression which was severely felt by the government—work on many of the proposed projects for which plans had been prepared being indefinitely deferred.

Of foremost importance of the port projects are the Manila harbor improvements, embracing the construction of Pier No. 7. This pier is to be in every respect a modern marine terminal of permanent construction, designed to meet all requirements of the largest vessels afloat which make Manila a port of call, such as the *Empress of Canada* and the *Golden State*. These vessels are exceptionally high and have very large cargo capacities which require that the pier, to be of real value and modern in every respect, must be of such dimensions as to properly accommodate them; otherwise the benefits that both shippers and government will derive from this new structure will be greatly impaired.

As planned, the pier is to be 1,400-ft. long from the pier head street line to the harbor limit line. Its facilities for handling freight and dispatching ships will be second to none. When completed and fully equipped, this pier will be the largest and most modern marine terminal in the Orient, capable of berthing four of the largest vessels simultaneously. It will have a freight handling capacity of three times the combined capacities of Piers No. 3 and No. 5.

Studies and reports were made on the feasibility of dredging the lower reaches of the Iloilo River to greater depths than those proposed on dredging plans previously approved. A considerable amount of data was obtained and compiled for the information of the Wood-Forbes mission, relative to the magnitude, type, depths of anchorages, etc., pertinent to ports and port structures throughout the archipelago.

The William A. Jones memorial bridge, over the Pasig River, the construction of which was supervised by the designing division, was thrown open to vehicle traffic August 22, 1921, and was practically completed in November, 1921, and fully commissioned in December, 1921.